Electrical World

OCTOBER 28, 1944

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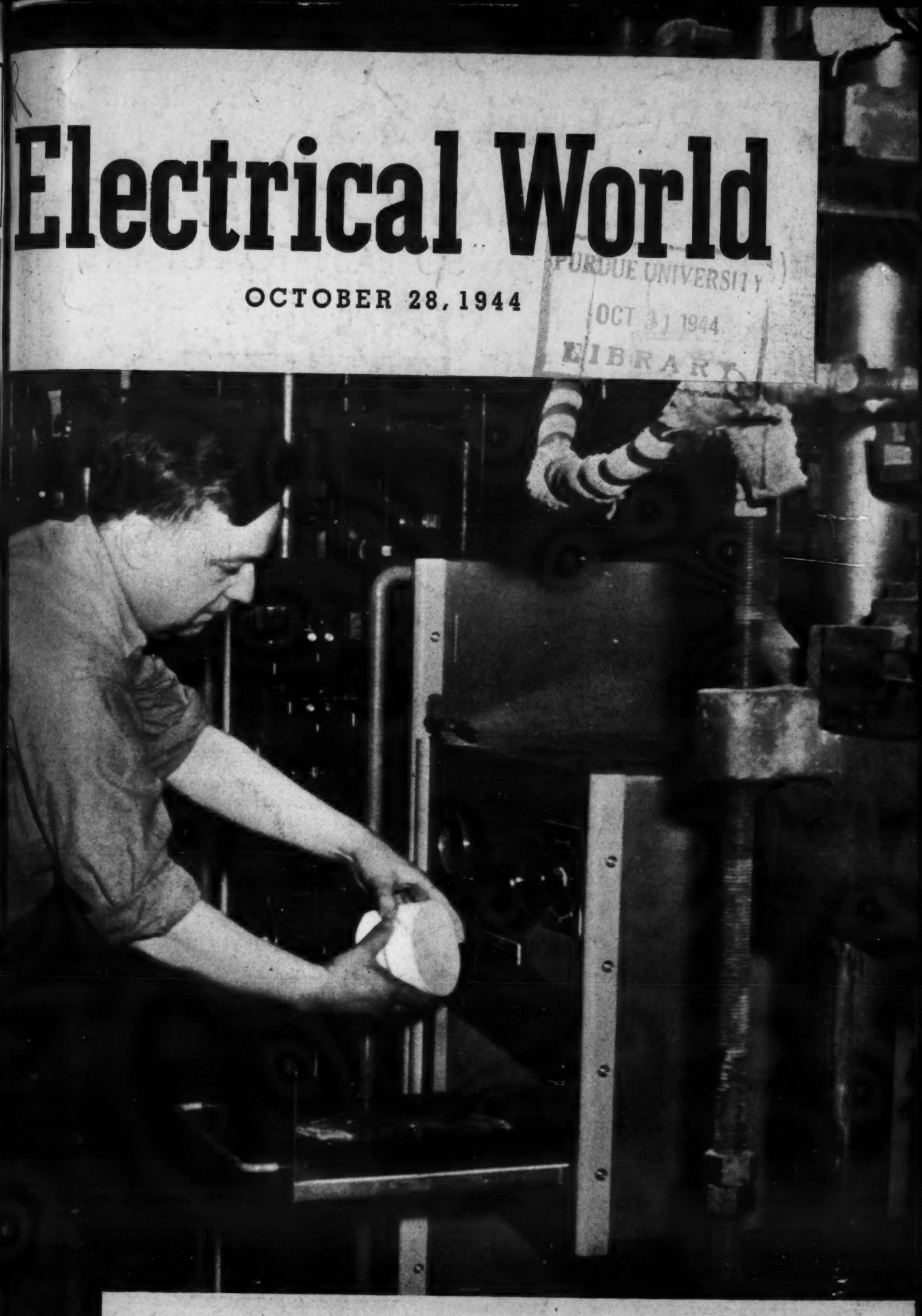
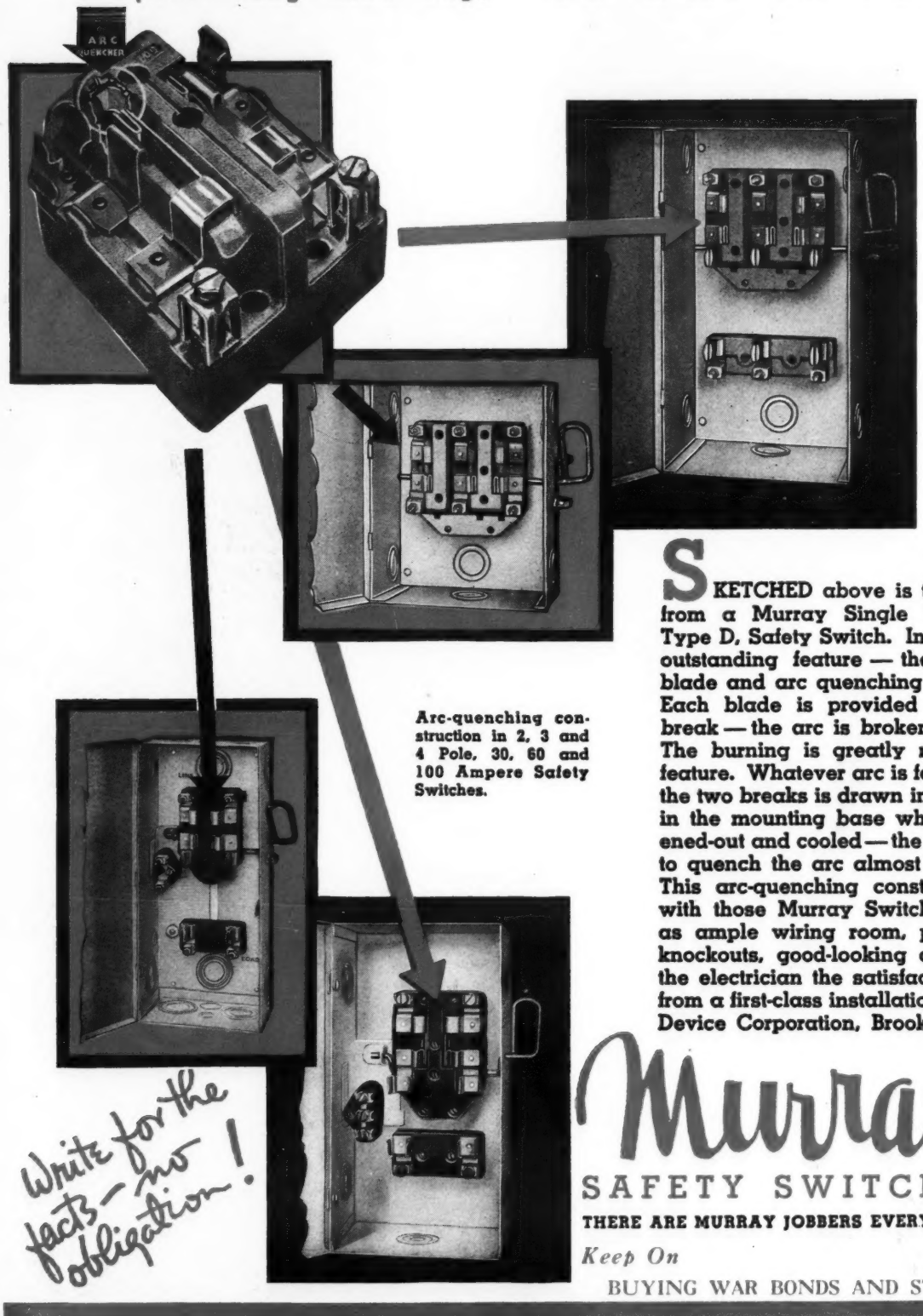


HIGH-FREQUENCY EQUIPMENT HARNESSES DIELECTRIC LOSSES

"A FIRST CLASS INSTALLATION", *say electricians*

(*and they also say,* "SO EASY TO PUT IN")



Arc-quenching construction in 2, 3 and 4 Pole, 30, 60 and 100 Ampere Safety Switches.

SKETCHED above is the switch block from a Murray Single Throw, Fusible, Type D, Safety Switch. In the circle is the outstanding feature — the double break blade and arc quenching chamber.

Each blade is provided with a double break — the arc is broken into two parts. The burning is greatly reduced by this feature. Whatever arc is formed at each of the two breaks is drawn into a narrow slot in the mounting base where it is lengthened-out and cooled — the effects co-acting to quench the arc almost instantly.

This arc-quenching construction coupled with those Murray Switch characteristics as ample wiring room, properly placed knockouts, good-looking cabinets, assure the electrician the satisfaction that comes from a first-class installation. Metropolitan Device Corporation, Brooklyn, New York.

Write for the facts — no obligation!

Murray

SAFETY SWITCHES

THERE ARE MURRAY JOBBERS EVERYWHERE

Keep On

BUYING WAR BONDS AND STAMPS

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 70 YEARS

October 28, 1944

Vol. 122, No. 18

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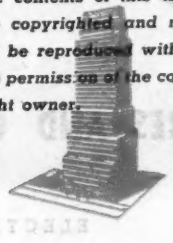


CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY,
330 West 42nd Street, New York 18, N. Y.
Director of Circulation:

Please change my address on Electrical World

From .....

.....

To .....

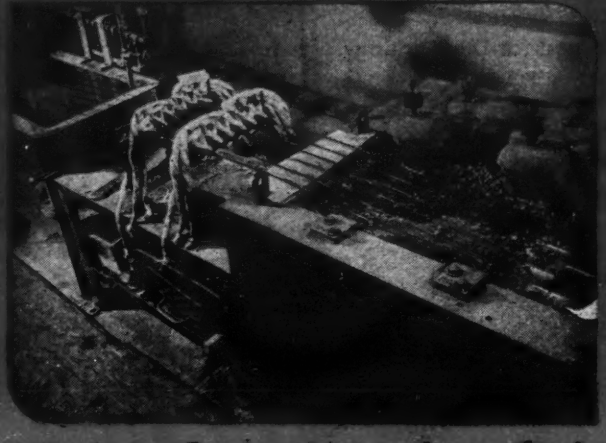
.....

Signed .....

OKOLOY

...an Okonite "First" for the Navy that will benefit You

• Before coating conductors with Okoloy, the annealed copper wire is electrolytically cleaned, thoroughly scrubbed, wiped, rinsed and wiped again.



• After cleaning and coating with flux, the wire passes through the Okoloy bath where, under carefully controlled temperature, the corrosion-resistant coating is applied. Heat-resistant, fiber glass wipers smooth the coating as the wire emerges from the tank and a final quenching completes the process.

• Comparative tap water immersion test on Okoloy and tin-coated, rubber-insulated wires (above). Note the corrosion and almost total loss of tin and pitting of enlarged photo of copper conductor shown in circle. Note also that Okoloy (right) is unaffected by the same composure.

When the war came, the Navy was forced to discontinue the tin coating they always used on the conductors of rubber-insulated wires and cables.

Over 16 years ago, Okonite chemists and research engineers, dissatisfied with the then standard practice of tinning, because it often led to failure and premature destruction of expensive cables, developed and perfected Okoloy, a lead alloy coating that outlasts tinning at least 2 to 1.

Thus Okoloy, in service on industrial cables for many years, was ready when the Navy could no longer get tin.

If *you* want your electrical cables to have conductors that resist corrosion, prevent contamination of the insulation, and stay clean for easy splicing and termination, specify Okoloy long-lived conductor coatings. Write for Bulletin OK-2019 if you would like additional data. The Okonite Company, Passaic, New Jersey.

OKONITE

INSULATED WIRES AND CABLES

3806

Post-war pipe dreams you better not count on

JET-PROPELLED GUY ANCHORS THAT INSTALL THEMSELVES.

No work, no bother, no fuss. Just switch on the rockets and watch it dig in. Who knows — It may come some day, but it won't be tomorrow!

BUT YOU CAN PLAN RIGHT NOW TO—

CUT POLE-LINE INSTALLATION TIME WITH HUBBARD HARDWARE

Engineered to be used together; manufactured to close tolerances so that parts fit right, the *first* time — Hubbard products cut installation time amazingly. Special steels and galvanizing make for long, trouble-free service. A Graybar Specialist is at your service with product information and application aid.

GRAYBAR'S NATIONWIDE NETWORK

of more than 80 warehouses assures you a convenient local source of supply for more than 60,000 electrical items — backed by experienced application aid on material for power-line construction or maintenance and on problems of wiring, lighting, communication and power apparatus. A Graybar Man near you is ready to make your electrical supply problems his personal responsibility. Why not take advantage of his time-saving assistance?

5527

via GraybaR

ATTENTION — MANUFACTURERS OF ELECTRICAL EQUIPMENT AND APPLIANCES: To help plan for more efficient distribution — national or regional — write for this new booklet: "Tomorrow's Electrical Distribution — Via Graybar."

GRAYBAR ELECTRIC COMPANY

IN OVER 80 PRINCIPAL CITIES

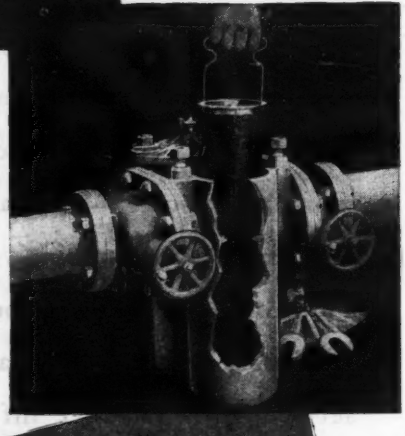
Executive Offices: 420 Lexington Ave., N. Y. 17, N. Y.

In wartime it's doubly important to *keep liquids clear!*

Stoppage of a pump or other equipment on the production front, is as bad as the jamming of a machine gun on the battle front. In the prevention of stoppage due to foreign matter in pipe borne liquids, Elliott strainers are playing a major part in America at war. These strainers in their various types and sizes are protecting vital water handling equipment in utilities and power plants everywhere, as well as on shipboard. They are also keeping trouble out of oil lines feeding oil burners and lubrication. To say nothing of thousands of applications in process work, where solutions are handled of various degrees of viscosity, from benzine to glue or molasses.

If you have a straining problem, talk it over with Elliott engineers.

THE SELF-CLEANING STRAINER
employs a slowly rotating central element which blanks out each straining section in turn, permitting it to be flushed and cleared by backflow of water. A comparatively new Elliott product, but already widely used for duty within its range. Sizes 4 in. to 24 in., pressures up to 125 lb. gauge.



TWIN OIL STRAINER
Particularly for lubricating and fuel oil lines. A development of the famous Twin Strainer, with strainer basket of proper mesh for its purpose. Cleaned manually, without interruption of service. Available in two types, from 1 in. to 12 in. pipe size, and up to 300 lb. working pressure.

ELLIOTT COMPANY

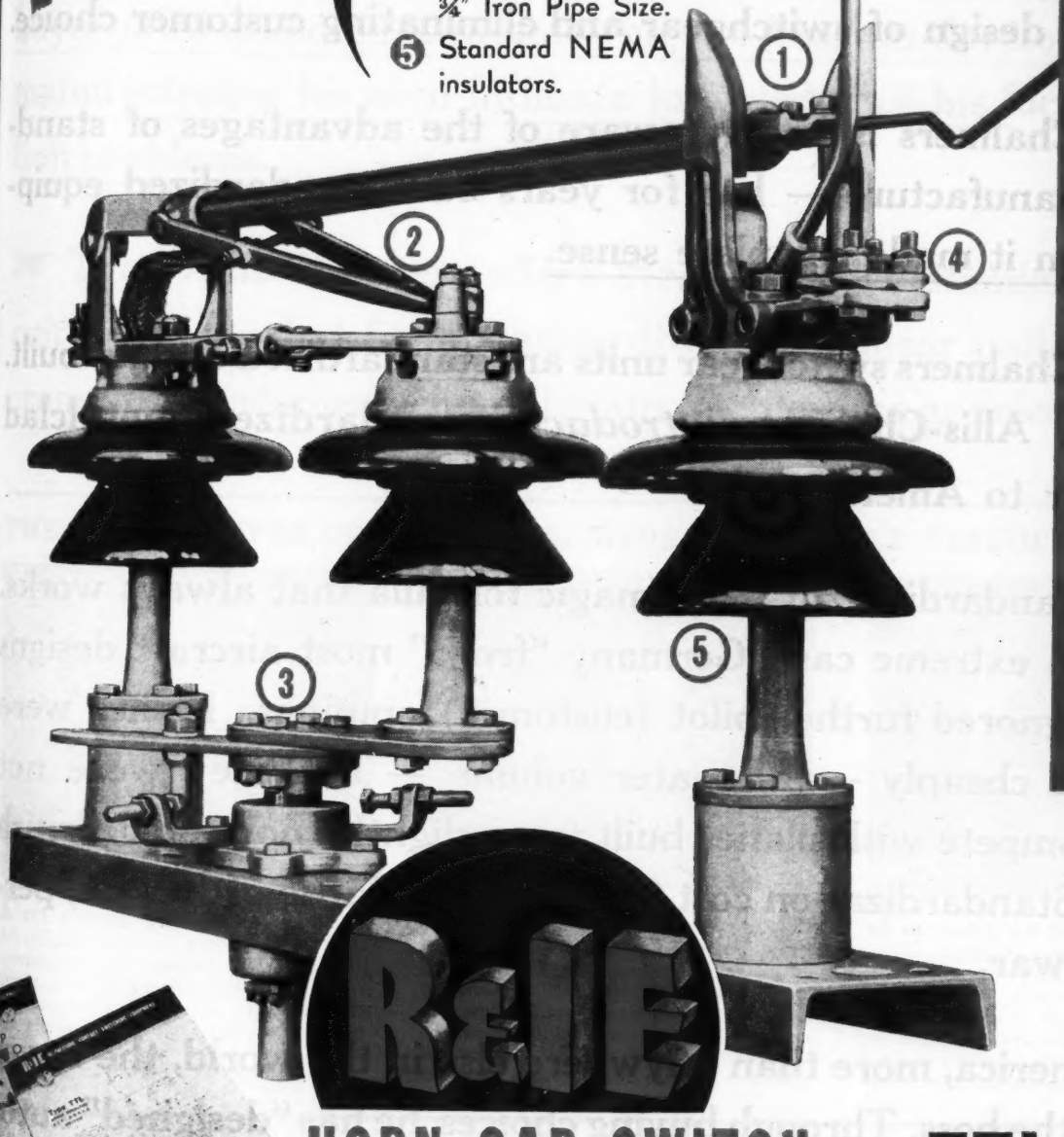
Accessories Department, JEANNETTE, PA.
DISTRICT OFFICES IN PRINCIPAL CITIES

TWIN STRAINER. *Always one side in operation while the other is shut off and available for cleaning. Made in a variety of types for all needs, and in sizes 2 in. to 42 in. For any working pressure up to 150 lbs. Also single strainers where occasional shut-down for cleaning is permissible.*

A-880

CHECK the FACTS

1. HI-PRESSURE, self-cleaning contacts — one piece jaw and terminal.
2. Few, rugged, non-ferrous parts. Simple, easy operation.
3. Weather-sealed, greaseless, anti-friction bearing using a forged rotor for maximum strength.
4. Clamp type terminal, "TC" or "UC" universal, using 4 half-inch bolts on 1¾" x 1¾" NEMA drilling. . . . Supplied for conductor up to ¾" Iron Pipe Size.
5. Standard NEMA insulators.



The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES
INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

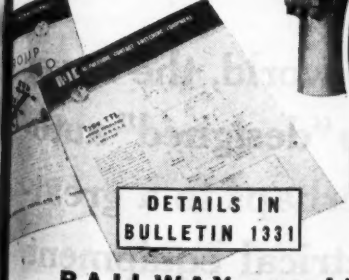
KIRK INTERLOCK SYSTEMS

AUTOMATIC SECTIONALIZING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

R&IE



DETAILS IN BULLETIN 1331

HORN GAP SWITCH *Type* TTL

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

BRANCH IN CANADA — EASTERN POWER DEVICES, LIMITED, TORONTO

A Statement on
of Switchgear

☛ We have been asked what our policy will be in regard to "freezing" design of switchgear and eliminating customer choice.

☛ Allis-Chalmers is keenly aware of the advantages of standardized manufacture — has for years built standardized equipment when it made complete sense.

☛ Allis-Chalmers switchgear units are standardized and jig-built. (Actually, Allis-Chalmers *introduced* standardized metalclad switchgear to America.)

☛ But standardization is no magic formula that always works. To cite an extreme case, Germany "froze" most aircraft designs by 1939, ignored further pilot (customer) opinions. Planes were built more cheaply — in greater volume — but they were not able to compete with planes built from slightly more fluid British designs. Standardization cost Germany the Battle of Britain, perhaps the war.

☛ In America, more than anywhere else in the world, the buyer has been the boss. Through buying choices, he has "designed" automobiles, "designed" washing machines, and — perhaps to a greater extent than anything else — "designed" electrical equipment.

Standardization

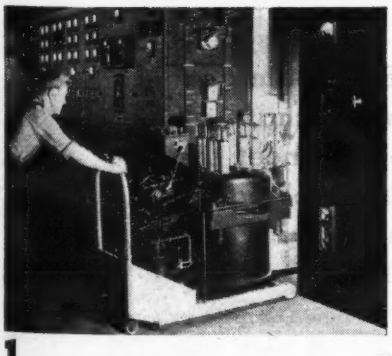
BY ALLIS-CHALMERS MFG. CO.

☛ **Allis-Chalmers believes strongly in this process—in which the buyer *with a choice to make* brings to bear on development and manufacturing his own intimate knowledge of his local application problems.**

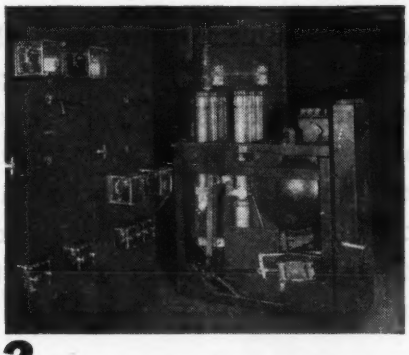
☛ **Thus Allis-Chalmers offers *three* types of standardized circuit breakers that fit in standardized switchgear units, does *not* cramp the customer's choice by any such means as price penalties.**

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

THE THREE TYPES OF ALLIS-CHALMERS METALCLAD CIRCUIT BREAKERS



1 OIL CIRCUIT BREAKER, as offered by Allis-Chalmers, is the product of 40 years' development and research. Mechanically simple, it is "Ruptor"-equipped for longer, maintenance-free operation. High impulse strength and its desirable application in certain atmospheric conditions promise to keep it a factor in the electrical industry.



2 AIR BLAST BREAKER, first commercially introduced to this country by Allis-Chalmers six years ago, gives unexcelled all-around performance. Arc interruption by means of prestored compressed air gives this breaker consistent half-cycle arcing time — longer contact life. Its principle of interruption makes it ideally suited to repetitive duty.

3 MAGNETIC AIR BREAKER is finding increased popularity among operators for moderate capacity installations, in 5 kv voltage and below. Fire hazard is reduced and handling of oil is eliminated. Contacts in the Allis-Chalmers "Ruptair" magnetic air breaker are accessible for inspection and maintenance without disturbing the arc chute.

A 1793

ALLIS AC CHALMERS

Boilers for the

A new concept in power generation made its appearance with the "Unit Power Plant" developed by Westinghouse Electric International Company.

This compact, effective steam-electric generating unit, adaptable to operation in any part of the world and under all climatic conditions, is built to standardized designs, permitting it to be broken down into relatively small packages for ready transportation to inaccessible plant sites. Special emphasis is placed on durability of equipment and simplicity of operation.

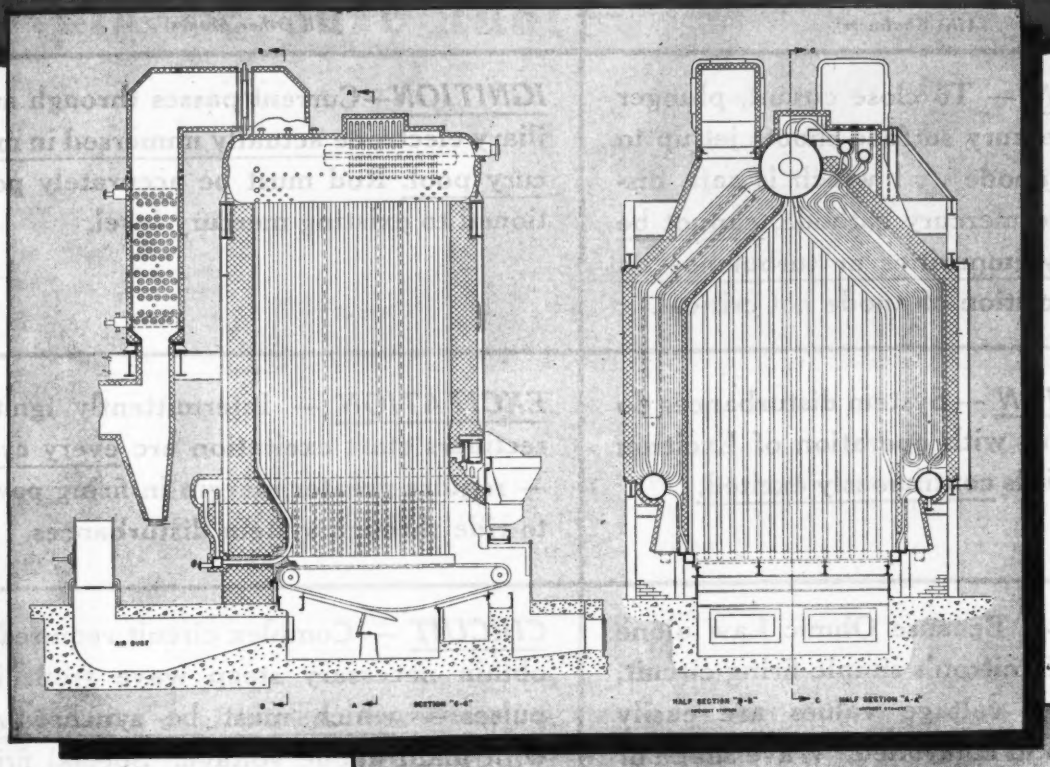
Many of these Unit Power Plants are already under way for China and Russia, for installation on the hot reaches of the upper Yangtze River to the arctic steppes of northern Siberia.

A study of the various boiler designs available for this severe duty led to the selection of Foster Wheeler type S-A steam generators for thirty-seven plants, the record showing that "all parties agreed upon this boiler as best adapted to meet the peculiar design, erection and operating conditions involved. Its compactness, freedom from unmasked refractories, adaptability to a variety of fuels, methods of firing and its free circulation influenced the selection."

FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, N. Y.

FW FOSTER

UNIT POWER PLANTS



"S-A" steam generator for China

Architect's drawing of "Unit Power Plant" for Russia

Foster Wheeler is a four star winner under the U. S. Navy Board of awards for production.

WHEELER

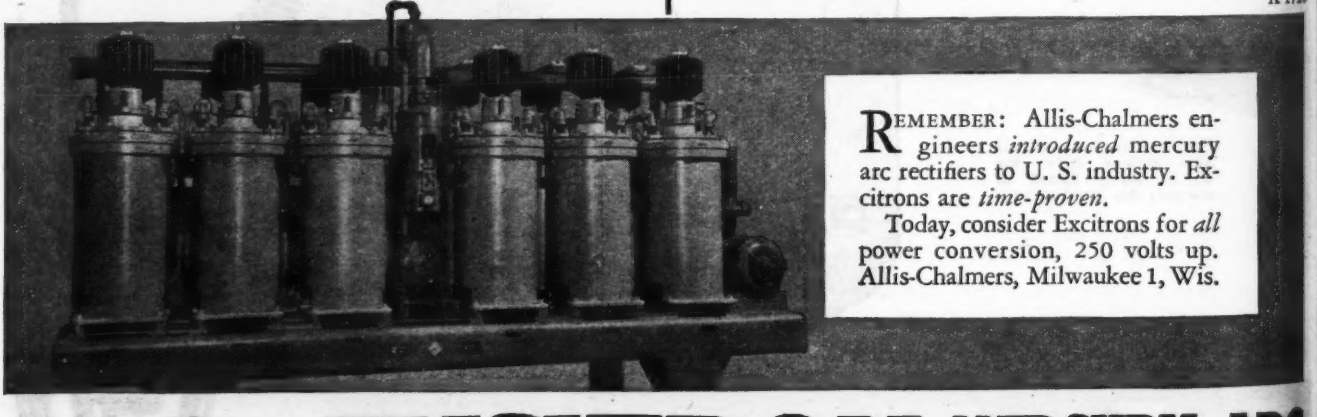
COMPARE ARCS

Before you Invest in any Mercury Arc Rectifier!

CONTINUOUS PILOT ARC (Allis-Chalmers)	INTERMITTENT PILOT ARC (All Other Makes)
IGNITION — To close circuit, plunger beneath mercury surface shoots jet up to excitation anode . . . which is safe distance above mercury cathode, cannot be affected by impurities or turbulence on surface. Position of anode not critical.	*IGNITION*—Current passes through auxiliary electrode actually immersed in mercury pool. Rod must be accurately positioned to existing mercury level.
EXCITATION — System disturbances do not interfere with operation of Excitron —because it is continuously excited.	*EXCITATION* — Intermittently ignited rectifiers start excitation arc every cycle — require greater margin in firing power to ride through system disturbances.
CIRCUIT — Because Ohmic Law alone applies to Excitron's simple firing circuit, current and voltage values are easily measured and controlled. Wave shape of supply voltage does not affect operation — as direct current is used exclusively. No need to tune circuit.	*CIRCUIT* — Complex circuit required to obtain necessary steep wave front impulses — which must be synchronized with main anode voltage. Special firing circuit includes special transformers, reactors, capacitors, plate type rectifiers.

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

A 1720



REMEMBER: Allis-Chalmers engineers *introduced* mercury arc rectifiers to U. S. industry. Excitrons are *time-proven.*

Today, consider Excitrons for *all* power conversion, 250 volts up. Allis-Chalmers, Milwaukee 1, Wis.

ALLIS-CHALMERS EXCITRON MERCURY ARC RECTIFIERS

We broke 4000 suspension insulators

Just to be sure that—

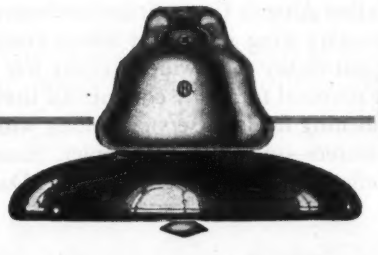
In the course of a single test, to get just one set of facts, O-B laboratory technicians pulled to destruction enough suspension insulators to build 25 miles of conventional 69-kv., H-frame line. That's a lot of ruined insulators! They must have wanted the information badly--they did. It must have been valuable information--it was!

On the data from this test was established a mathematically precise method of sampling O-B insulator production. The law of probability is just as sure as 2+2=4, providing your sample is representative of the whole, so we destroyed 4000 insulators to be sure of our figures.

Resulting from this test was a new standard of suspension insulator strength rating--minimun unit strength. Old average strength has been abandoned. It worked on paper but not on the line, where insulators hang in strings whose strength depends upon the weakest member.

Frankly, it wasn't as brief or as simple as all this. No one had ever tried making insulators to the rigid standards which this new inspection method imposed. But it resulted in this. When you see "O-B" on an insulator cap, and beneath this a strength rating, that is *minimum strength*--a specific rating applying to that particular unit. It assures you the kind of strength that *counts*, because you can *count* on it!

2493-H

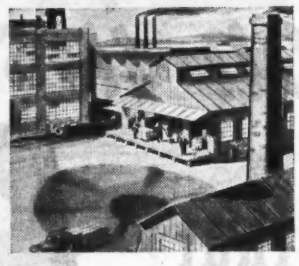


Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LIMITED
NIAGARA FALLS, ONTARIO

ANSWERING SOME HELICOPTER QUESTIONS



The past century has witnessed the development of the telegraph, electric light, telephone, automobile, airplane, radio and many other industrial marvels, which are still in the process of transforming living conditions throughout the world. And today there is wide enthusiasm over *another* revolutionary development—the helicopter . . . and wide curiosity concerning *its* future possibilities.

Therefore it is timely to publish a sincere and factual appraisal of the helicopter and an informed statement of the part it may play in future progress. As one of a dozen or more substantial and conservative industrial organizations engaged in helicopter development—the oldest in the rotary wing field—Kellett Aircraft Corporation accepts this opportunity to present some helicopter facts and to state the opinions of its management and engineering staff on the future of the helicopter.

DEVELOPMENT HAS BEEN RAPID

Today, in the United States, a half dozen or more different helicopter types are flying. To the best of our knowledge, helicopters are flying in no other country, and only in the United States is effective research and production being carried on. This is largely due to the sponsorship received from our military services during the war period.

WHAT CAN HELICOPTERS DO?

The helicopter, as a matter of normal flying operation, can rise straight into the air from a standing start; land in the same way; hang motionless in the air at low altitude over a given point for as long as the pilot wishes; fly backwards as easily as your automobile reverses; move directly sideways; fly safely inside a large auditorium.

ARE HELICOPTERS EASY TO FLY?

The men who pilot helicopters today are carefully trained, experienced men. Flying a helicopter is not a job for a novice. Many controls must be coordinated and the pilot must possess excellent skill and judgment. However, these "experts" are otherwise average individuals and one or two of them had never had experience in flying before they stepped into helicopters. It is reasonable to expect that "ease of flying" will be improved with further engineering developments.

WHAT WILL HELICOPTERS COST?

Helicopters, if they could be purchased on the market today (which military requirements will not permit), would be more expensive than the most costly automobile. Engines, intricate transmissions, control mechanisms and rotor blades require special design and construction methods. Helicopters are likely to be costly for some time to come. Of course, if the efficiency of mass production and the competitive enterprise system are permitted to have their effect, the cost is certain to come down.

ARE HELICOPTERS SAFER?

It has not yet been demonstrated that a helicopter is any more safe or less safe than other aircraft. Conventional airplanes have established impressive records for safety.

WHO WILL USE HELICOPTERS?

It is our belief that helicopters will have their first important usefulness in fields where other forms of transportation cannot serve. In many situations the helicopter will introduce important savings of time, manpower and money. For instance, in the spraying of agricultural crops, inspecting and servicing of cross country oil pipe lines and electric transmission lines; forest and shore patrol; prospecting; in mail and passenger service to areas otherwise inaccessible by air.

WILL HELICOPTERS BE FAST?

As aircraft, helicopters today are not very fast. To a world which accepts 400 m. p. h. flight as commonplace, they may never become "fast" aircraft. BUT the helicopter's as-a-crow-flies travel is much faster than automobile or train transportation, and even faster in some cases than the combination of land and plane travel which present-day air transport entails. The practical helicopter will not require a trip to an airport as a necessary preliminary to a flight.

WHAT ABOUT HELICOPTER CAPACITY?

Helicopters are still in the medium-power, cabin class. It may be some time before a type will develop which will cruise more than a few hundred miles without refueling or which will carry more of a load than a sedan.

HOW RAPIDLY WILL HELICOPTERS BE PERFECTED?

As in the case of the airplane, development of the helicopter is a matter of engineering. The present-day airplane is the result of many millions of engineering-man-hours over a period of years. The present-day helicopter is the result of several hundred thousand engineering-man-hours over a period of years—inconsequential as yet, compared with the engineering applied to the airplane of today. Over the years to come, additional millions of engineering-man-hours must be expended in order that the helicopter shall make its maximum contribution to progress. How soon that goal is reached depends on the rapidity with which the engineering investment can be made.

KELLETT HELICOPTERS

Kellett Aircraft Corporation has been a designer and builder of rotary wing aircraft for fifteen years. We have confidence in our ability to provide after-the-war helicopters which will be practical for many commercial uses. We look forward to widening fields of service—along with other aircraft manufacturers—in a better, happier, more air-minded future. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Pa.

KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

They Haven't Yet Specified
WHAT REALLY COUNTS
in Station Insulators

BUT-will it give the service you expect?

Measuring and testing a new switch and bus insulator fresh from the factory tells you this--it meets established standards for this class of insulation.

All this measurement and all this testing fails, in a large degree, to answer this question--how long will it operate without making trouble?

This is what really counts in a switch and bus insulator, and it can't be covered by any set of specifications.

But here is a fact you can tie to. As a part of O-B's largest and longest service records in the industry, thousands of these insulators have passed thirty years and are still going strong. Advancements have made today's insulator a better product than these "pioneers". Therefore you can place your confidence in O-B switch and bus insulators--not based on mere claims or technicalities, but based on the record!

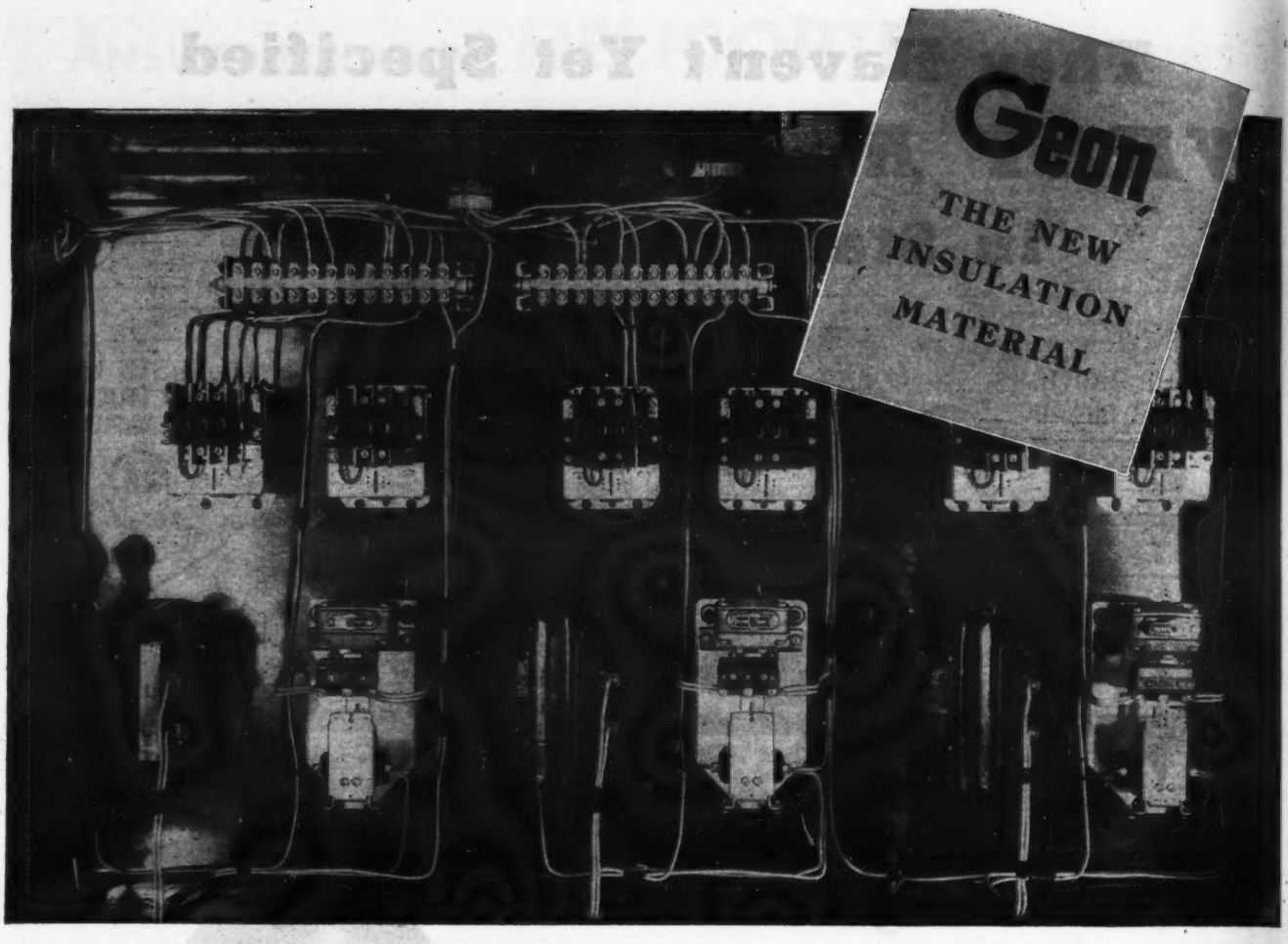
Into O-B switch and bus insulators go all those things that *can* be specified, plus that essential quality of long service life that cannot be defined, but can be proved by the longest station insulator service records in the industry. There is one simple way to specify this--just put O-B on your next order.

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LIMITED
NIAGARA FALLS, ONTARIO

2492-H



For long-life, trouble-free control panel and switchboard wiring

FROM GEON vinyl resins may be made a wide variety of flexible thermoplastics possessing unusual electrical properties. One such formulation is GEON 6373, especially compounded for control panel and switchboard service.

Wire insulated with GEON 6373 permits a thinner layer of insulation and so saves space. The smooth surface of GEON insulation means easy installation and maintenance. Its flame resistance means greater safety. And recognized authorities have approved it for use in sustained operating temperatures up to 80°C.

It is easily processed directly onto the wire and can be brilliantly colored for immediate identification. Its high abrasion resistance permits its use where vibration may be a factor. Its resistance to normal aging means a service life many times that of conventional insulating materials.

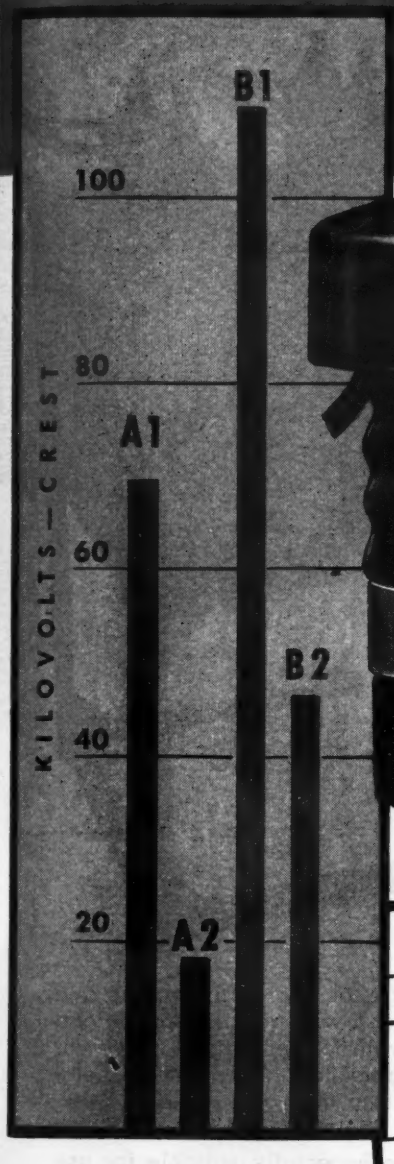
Other compounds may combine these and the following additional characteristics in a wide variety of combinations to meet specific service requirements: resistance to acids, alkalies, almost all chemicals; resistance to light, heat, cold, ozone; light weight; and many others.

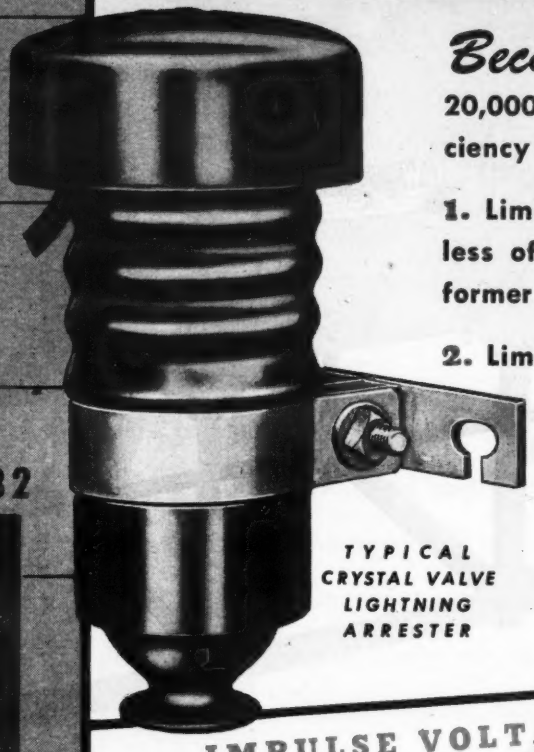
GEON is currently available to industrial users subject to allocation under General Preference Order M-10. But limited quantities can be had for experiment. And our research staff and laboratory facilities are available to help you work out any special problems or applications. Just write Department C-5, Chemical Division, The B. F. Goodrich Company, 324 Rose Building, E. 9th and Prospect, Cleveland 15, Ohio.

Geon
Vinyl Resins & Plastics

CHEMICAL DIVISION
THE B. F. GOODRICH COMPANY
ROSE BUILDING, E. NINTH & PROSPECT, CLEVELAND 15, OHIO

CV's Prevent High Stress across Insulation





TYPICAL CRYSTAL VALVE LIGHTNING ARRESTER

Because **. . . in discharging 20,000 amperes their high efficiency . . .**

1. Limits the voltage to 43% or less of the chopped wave transformer *test voltage*.

2. Limits the voltage to 50% or less of the full wave transformer *test voltage*.

3. Limits the voltage to a value less than the 60 cycle one minute insulation *test voltage*.

IMPULSE VOLTAGE LEVELS

TRANSFORMER TEST		PERMITTED BY CRYSTAL VALVE	
A1 ➧ 2400 VOLTS		3000 VOLT RATING	➧ A2
Chopped Wave	69 KV	19 KV-IR Drop 20000 Amperes 10x20 Wave	
Full Wave	60 KV	14 KV-Impulse Breakdown	
60 Cycle Crest—1-Minute	27 KV	11 KV-IR Drop 1500 Amperes 10x20 Wave	
B1 ➧ 7200 VOLTS		9000 VOLT RATING	➧ B2
Chopped Wave	110 KV	47 KV-IR Drop 20000 Amperes 10x20 Wave	
Full Wave	95 KV	43 KV-Impulse Breakdown	
60 Cycle Crest—1-Minute	48 KV	31 KV-IR Drop 1500 Amperes 10x20 Wave	

ELECTRIC SERVICE MANUFACTURING COMPANY • 17th & CAMBRIA STS., PHILA. 32, PA.

CRYSTAL VALVE

LIGHTNING ARRESTERS

Use G&W Type "FC" OIL FUSE CUTOUTS for multiple circuit FUSE-SWITCH centers

Type "FC," Style "B" Oil Fuse Cutout
5000 volts — 200 amps. — 25000 kva.

Interlocking cover and cover clamp insures safety when replacing the simple, inexpensive fuse link. Beryllium copper springs make ideal full load break switching contacts. Unit detachable porcelain cable entrance bushings with closed hood nuts definitely seal bottom of cutout tank against oil leaks.

THE UNIT shown takes care of one main circuit and four branch circuits . . . each with gang-operated load break oil disconnects and with oil immersed fuses for overload and short circuit protection. Completely metal enclosed—safe and satisfactory for any location—outdoors, indoors or in vaults.

These Type "FCBX" units are especially suitable for use in locations which are exposed to corrosive fumes, explosive gases, salt air and inflammable dust.

Welded steel boxes with Type "FC" Oil Fuse Cutouts, factory assembled to meet individual requirements, save space and installation labor.

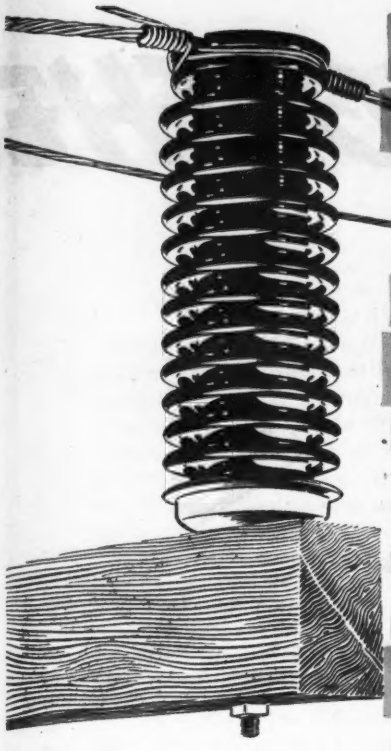
Write us or our nearest representative for further data.

G&W ELECTRIC SPECIALTIES

Originators and pioneers of equipment for sound methods of underground and overhead electric distribution.

G&W ELECTRIC SPECIALTY CO.
7780 DANTE AVE., CHICAGO 19, ILL., U.S.A.
Also made in Canada by Powerlite Devices, Ltd., Toronto

Potheads . . . Boxes . . . Oil Fuse Cutouts . . . Oil Switches . . . Multiple Circuit Disconnects

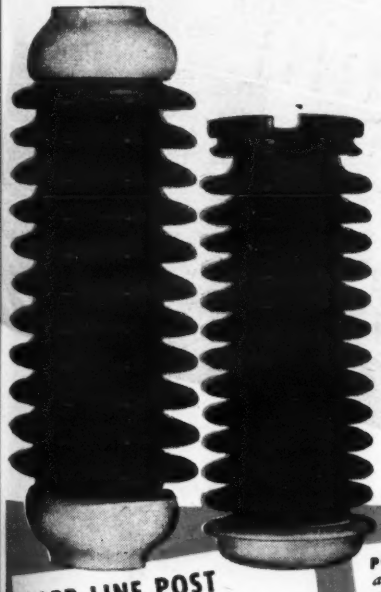


WARTIME CONSTRUCTION

need not be "TEMPORARY CONSTRUCTION"

TRANSMISSION LINES ON WOOD POLES AND LAPP LINE POSTS ARE LONG-LIFE, LOW-TROUBLE LINES . . . . . THAT GO UP FAST AND USE A MINIMUM OF MATERIAL

• On a cost-per-year basis, transmission line construction on wood poles with Lapp Line Posts is most practical and economical. And today, if load demands make it necessary for you to build a new line under war-emergency restrictions, you'll find this same construction will require least in critical materials, least in man power. The extra height of Lapp Line Posts will give your line better clearance, or even in some cases permit use of shorter poles. Coordinate necessity measures with your long-time planning and build low-cost long-service lines—on Lapp Line Posts.



LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

BACKING THE

BUY MORE WAR BONDS!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ BABCOCK

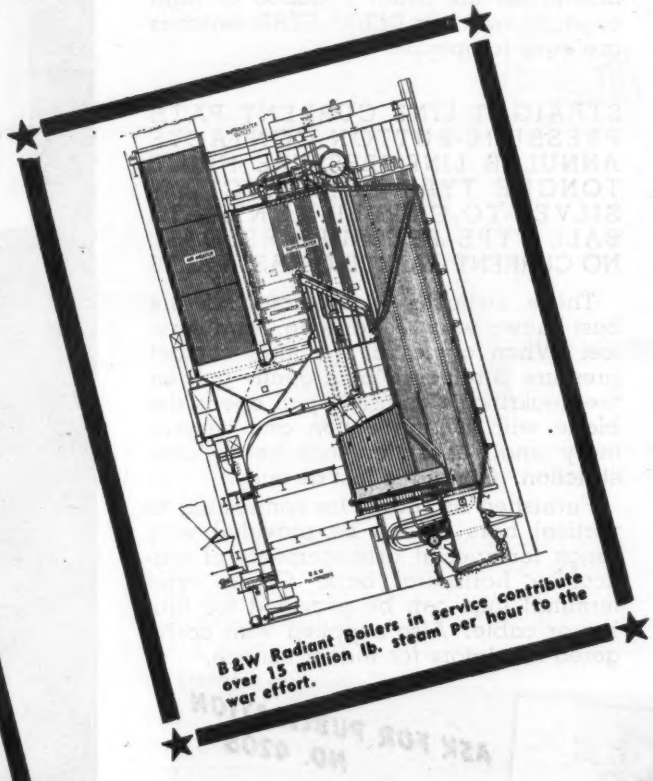
...ATTACK...with POWER

What's back of the smashing offensive that is carrying the war to the Axis? The dynamic energy of management and labor . . . the amazing ingenuity of engineers . . . and, not least, the gigantic load shouldered by our public utilities and industrial power plants.

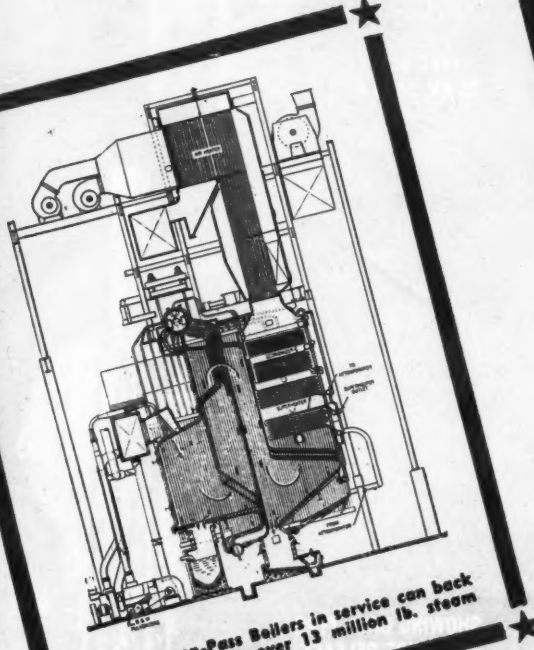
It would be impossible to over-emphasize the importance of power to the almost incredible production of ships, planes, tanks, guns, ammunition, and other war material. In producing steam to supply electrical energy, American power plants are keeping war-plant machines humming at stepped-up speeds never before attained. As J. A. Krug of WPB aptly sums it up, "Power has never been too little or too late."

Working with power plant executives and personnel has been a privilege for Babcock & Wilcox . . . and an opportunity to apply our experience in steam generation to the war-vital needs of expanding and maintaining boiler capacity.

We at B&W know that when the history of this war is written, the electric light and power industries will receive high recognition for a job well done . . . even wider recognition than the special citation already conferred upon them "for distinguished wartime achievement."



B&W Radiant Boilers in service contribute over 15 million lb. steam per hour to the war effort.



B&W Open-Pass Boilers in service can back the attack with over 13 million lb. steam per hour.

The Babcock & Wilcox Company

85 Liberty Street, New York 6, N. Y.

& WILCOX ★★★★★★★★★★

G-274T

"B-2P" HIGH CURRENT SWITCHES ARE EASY TO OPERATE

CAPACITIES—2000-3000-4000-5000-AMPERES

DELTA-STAR heavy duty disconnecting switches can be counted upon to meet war production demands of continuous heavy load. Rugged in construction, they're built to carry full rated load continuously without overheating yet overcome operating difficulties, the usual bugaboo of high capacity switches. DELTA-STAR switches are easy to operate.

CONSIDER THESE ADVANTAGES:

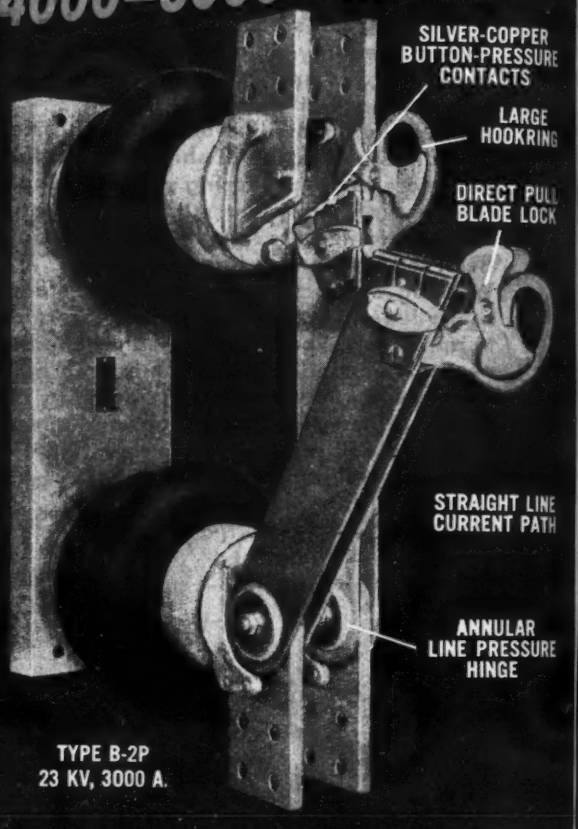
STRAIGHT LINE CURRENT PATH
PRESSURE-BUTTON CONTACTS
ANNULAR LINE-PRESSURE HINGE
TONGUE TYPE CONSTRUCTION
SILVER-TO-COPPER CONTACTS
BALL TYPE PRESSURE RELEASE
NO CURRENT CARRYING CAST PARTS

These switches incorporate all the best known features for long, hard service. When operated, the high contact pressure is released by a gentle pull on the hookring. Continued pull opens the blade with wiping action and surprisingly small effort for such heavy construction. Closing is just as easy.

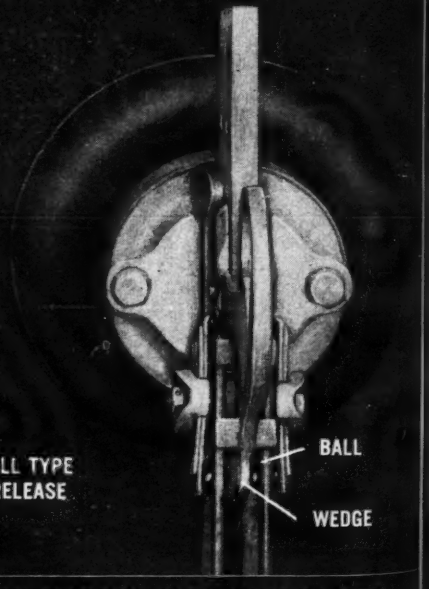
Furnished as shown for connecting to vertical bars or can be provided with tangs for special arrangements of vertical or horizontal bars. Clamp type terminal lugs can be provided for tubing or cable. Also supplied with corrugated insulators for indoor service.

ASK FOR PUBLICATION NO. 4205

For listing and dimensions of switches rated 7.5 to 34.5 kv, 2,000 to 5,000 amperes.



TYPE B-2P
23 KV, 3000 A.



SHOWING BALL TYPE PRESSURE RELEASE

DELTA-STAR ELECTRIC COMPANY

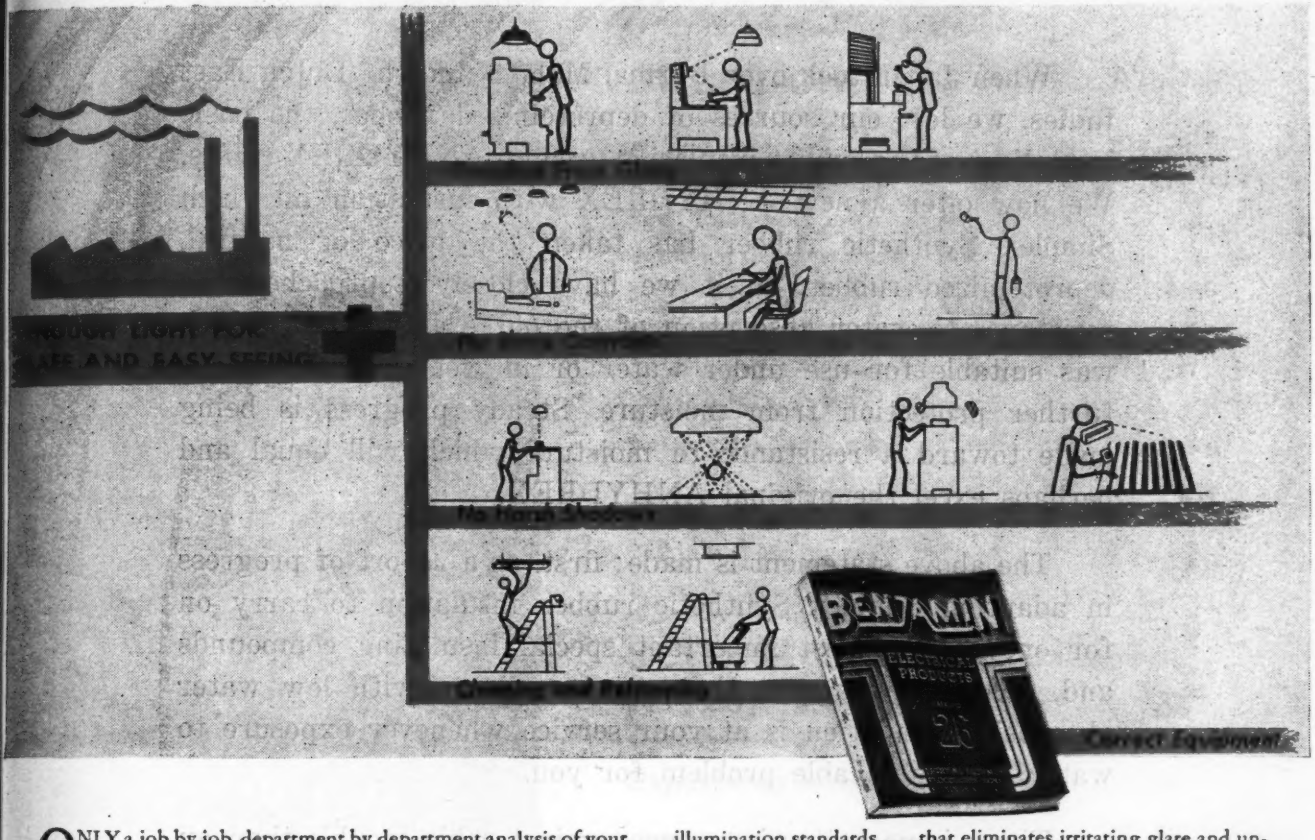
MAIN OFFICE AND FACTORY—2400 Block, Fulton St., Chicago 12, Ill.
NEW YORK OFFICE—140 Cedar St., New York 6, N. Y.

DISTRICT REPRESENTATIVES IN THE FOLLOWING CITIES

Birmingham, Ala.	Indianapolis, Ind.	Philadelphia, Pa.
Boston, Mass.	Kansas City, Mo.	Pittsburgh, Pa.
Buffalo, N. Y.	Knoxville, Tenn.	Richmond, Va.
Charlotte, N.C.	Los Angeles, Cal.	St. Louis, Mo.
Cleveland, Ohio	Minneapolis, Minn.	San Francisco, Cal.
Dallas, Texas	New Orleans, La.	Seattle, Wash.
Detroit, Mich.	Norfolk, Va.	Washington, D. C.
Denver, Colo.	Omaha, Neb.	Honolulu, Hawaii

CANADIAN ASSOCIATE
Canadian Line Materials Limited — Toronto 13, Canada

How does Your Lighting Check Up with Today's Higher Standards?



ONLY a job by job, department by department analysis of your lighting can determine the answers to the question: "How Does Our Lighting Check Up with Today's Accepted Standards?"

Such a check up will reveal:

1. **Are we providing our employes with the necessary light for easy and comfortable seeing?**
2. **Where and how can annoying direct and reflected glare be reduced?**
3. **What must be done to the lighting and to the working surfaces, the walls and ceilings to reduce sharp brightness contrasts which interfere with good seeing?**
4. **Where must sharp shadows be eliminated?**

Much of your production efficiency depends upon the proper answers to these questions. Lighting that meets today's higher illumination standards . . . that eliminates irritating glare and uncomfortable brightness can also be an important influence for better labor relations.

You can be sure of obtaining maximum results from your lighting by specifying Benjamin Lighting Equipment. Such specification assures you of lighting that conforms to all recognized industry standards through lighting equipment that is scientifically designed to provide proper shielding, adequate diffusion and efficient direction of light where most needed.

Without cost or obligation on your part, let us place your name and the names of your associates on our list of those to receive the various Benjamin bulletins and other data to be made available during the next few months. These will be helpful to you in making a study of your lighting and in planning needed improvements. Just write Benjamin Electric Mfg. Co., Dept. K, Des Plaines, Illinois and ask for Benjamin Re-Lighting Service Data.

Call for a Call
by a Trained Lighting Specialist

BENJAMIN TRADE MARK
Lighting Equipment
Distributed Exclusively Through Electrical Wholesalers

Simplex-Anhydrex Cables are Back With Simplex Synthetic Rubber Insulation For Underground or Submarine Service

When Japan took over Burma, Malaya and the Dutch East Indies, we lost our sources of deproteinized rubber, the basic ingredient of the rubber insulation used on ANHYDREX cables. We now offer a new ANHYDREX with insulation in which Simplex Synthetic rubber has taken the place of natural, deproteinized rubber. In it we have closely approached the resistance to water absorption of the old ANHYDREX which was suitable for use under water or in wet ground without further protection from moisture. Steady progress is being made toward a resistance to moisture which will equal and perhaps excel the original ANHYDREX.

The above statement is made; first, as a report of progress in adapting Simplex Synthetic rubber insulation to carry on for one of our most important special insulating compounds and, second, to suggest that our experience with low water absorption insulation is at your service whenever exposure to water creates a cable problem for you.

There is no better insurance against cable trouble than an effective barrier, such as ANHYDREX insulation, which will prevent moisture from getting into a cable and interfering with steady, uniform service. ANHYDREX cables with insulation made with Simplex Synthetic rubber can be depended upon for efficient performance under wet conditions.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex WIRES and CABLES

HIGH-INTERRUPTING CAPACITY POWER FUSES

Give your High Voltage Motors Modern Low Cost

SHORT-CIRCUIT PROTECTION

• The accepted use of S & C High-Interrupting Capacity Power Fuses by leading builders of 2300 and 4600 volt motor control equipment is good evidence of satisfactory performance. They provide accurate, dependable short-circuit protection in small space—at lower cost, and eliminate the need for back-up circuit breakers.

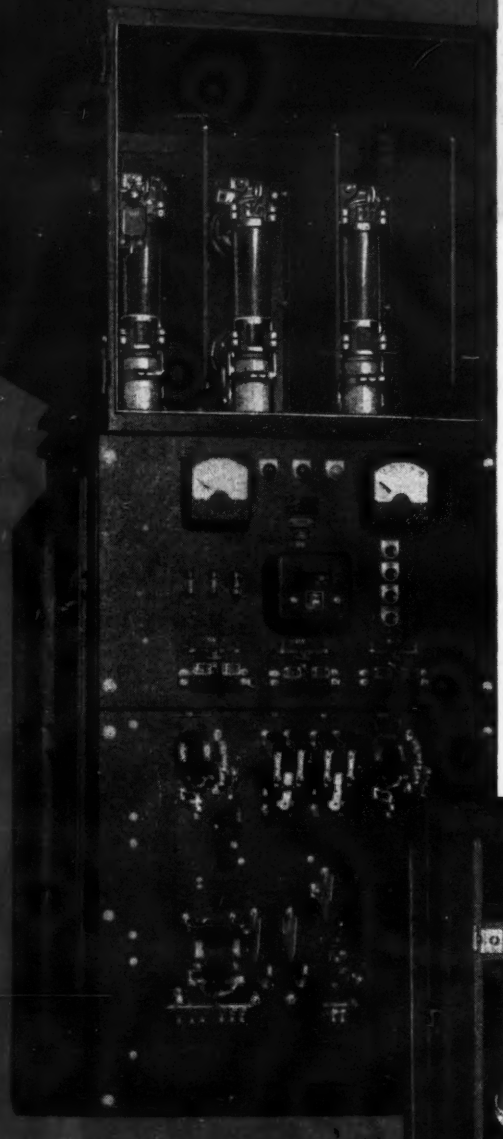
These S & C Power Fuses, easily serviced on the job, are precision-built with traditional S & C thoroughness. They provide reliable short-circuit protection up to 150,000 KVA at 2300 volts and to 250,000 KVA at 4600 volts. For details, write for Bulletin 200.

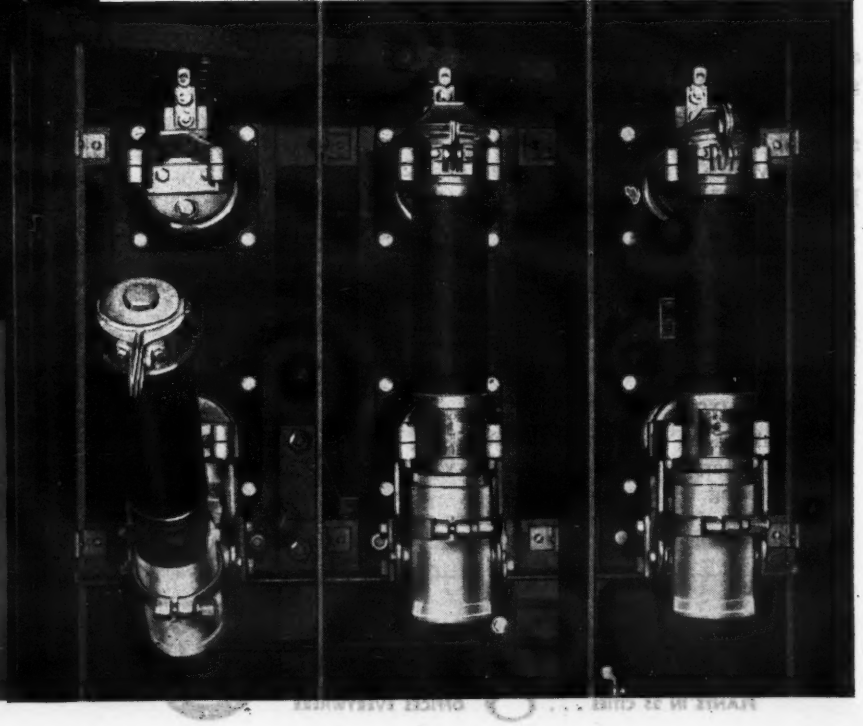
SCHWEITZER & CONRAD, INC.

4435 Ravenswood Ave., Chicago 40, U. S. A.

Supplied in Canada through Powerlite Devices, Ltd., Toronto, Ont.

Experience Will Choose the S & C Fuse





S & C High-Interrupting Capacity Power Fuses provide reliable short-circuit protection to the equipment and the system without involving related apparatus . . . a splendid example of modern engineering practice. Close-up at right shows one of these disconnect fuses in open position.

Eliminate

UNNECESSARY OUTAGES

on rural lines with the new Westinghouse AR-1 AUTOMATIC CIRCUIT RECLOSER

Here's a double-barrelled answer to unnecessary outages on rural lines—the new Westinghouse AR-1 AUTOMATIC CIRCUIT RECLOSER.

1. On temporary faults, the recloser restores service after opening and clearing the fault. This eliminates over 80% of unnecessary outages and service trips.

2. On permanent faults, the recloser locks out after attempting to restore service three times.

Due to time-lag tripping, only the recloser nearest the fault opens even once. Accurate co-ordination with other reclosers and standard fuses is possible only with time-lag tripping. Length of line out of service is reduced to an absolute minimum.

The recloser gives ideal protection to important loads, avoids revenue loss on dead lines and builds customer good will through better service.

Complete tables and charts on how to co-ordinate the recloser with other circuit protection are yours for the asking. Write today for booklet B-3329. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

J-60549

TIME-LAG TRIPPING

PERMITS

Co-ordinating reclosers with each other and with fuses
Burning faults clear and restoring service
Energizing line after lock-out without by-pass switch

PREVENTS

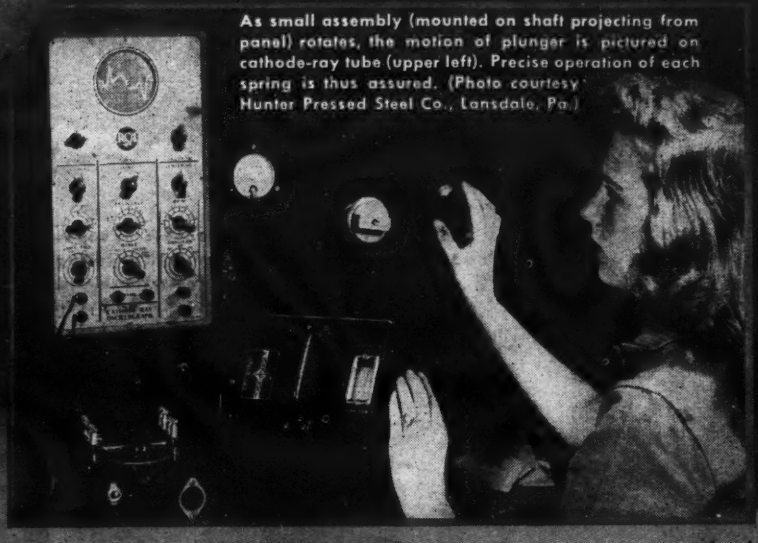
Simultaneous tripping of reclosers
Unnecessary tripping on momentary overloads
Chattering
Tripping of immediate and preceding reclosers when re-energizing line

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

AR-1 RECLOSER

Testing Springs with a "Picture" Tube



As small assembly (mounted on shaft projecting from panel) rotates, the motion of plunger is pictured on cathode-ray tube (upper left). Precise operation of each spring is thus assured. (Photo courtesy Hunter Pressed Steel Co., Lansdale, Pa.)

HOW HUNTER PRESSED STEEL COMPANY USES ELECTRONICS IN SPRING-MAKING

WHAT is a spring? At the Hunter Pressed Steel Company, it's a piece of "educated" metal — with a personality all its own. For Hunter engineers have made a real science of spring-making.

Since even a small spring may control an important machine or system, its performance must be extremely accurate and dependable.

To help make certain springs better — and to check their results precisely — Hunter engineers have pressed into service the famous RCA "picture" tube. This cathode-ray tube enables them to observe the performance, *under actual operating conditions*, of a small precision spring in a rotating assembly.

This spring is linked to a small plunger, and is extended and compressed by centrifugal force as the assembly rotates. In test, the assembly is rotated at predetermined speeds in a magnetic field. The motion of the plunger and the changes produced are flashed on the screen of the RCA Cathode-ray oscillograph, as shown in the photograph above. Thus, the cathode-ray tube "pictures" the spring action quickly and accurately while the assembly is in operation.

This is just one example of how *many jobs can be done better, cheaper, and faster the electronic way.*

The cathode-ray tube has many applications in industry. It can be used to make instantaneous measurements of electrical circuit performance; to make *continuous* observations of a wide range of processes; to compare dimensions, colors, speeds; to measure time intervals as short as a millionth of a second; in fact it can observe or measure any quantity that can be converted to voltage or current.

If you have a problem in any of these classes, it may well be that standard RCA cathode-ray tubes can be adapted to your requirements. In any event, why not write, stating your problem in detail? Our RCA Tube application engineers may be able to help you. Address: RADIO CORPORATION OF AMERICA, Commercial Engineering Section, Dept. 62-16W, Harrison, New Jersey.

Remember, the Magic Brain of all electronic equipment is a Tube... and the fountainhead of modern Tube development is RCA.

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

62-A327-16

1919 1944

A SILVER ANNIVERSARY

SERVING THE ELECTRICAL INDUSTRY with Modern Dependable Transformers

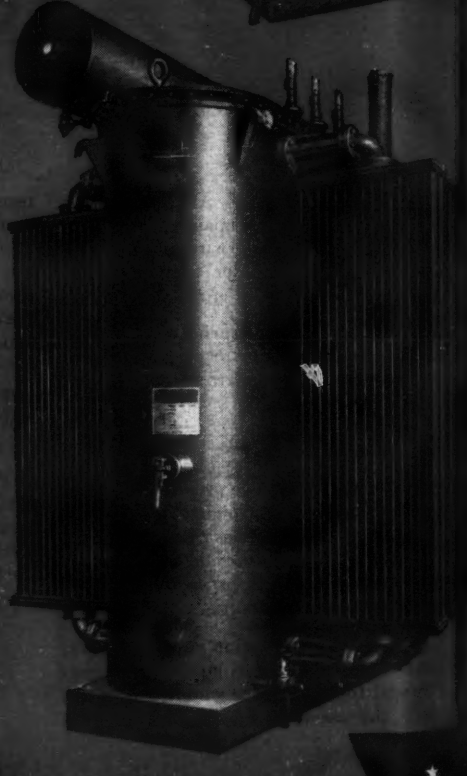
DISTRIBUTION—Outdoor types, capacities and voltage ratings to fit all utility and industrial applications. Self protected types for urban and rural lines are also available to meet modern requirements.

DRY TYPES—Air cooled, available in capacities from 5 VA up to 1,000 KVA. Floor, wall or ceiling mounting with Class A or Class B (all glass) insulation. A wide variety of designs are regularly produced for switchboard use, industrial plants and manufacturers of electrical machinery.

DISTRIBUTION—Indoor types, filled with Askarel (non-inflammable liquid). Often supplied with attached switchgear and operating accessories to form unit substations.

INSTRUMENT TRANSFORMERS—A full line of current and potential transformers and metering sets. Air cooled and oil immersed types up to 69,000 volts. Designs and accuracies meet the requirements of all American Standards.

POWER TRANSFORMERS—Designs up to 10,000 KVA, voltages to 69,000. Built to customer specifications. Unit substations include user specified switchgear and protective equipment. Custom built by long experienced engineers and craftsmen.



marking an important milestone in the steady growth of a **PROGRESSIVE COMPANY**

Since 1919, the Standard Transformer Company of Warren, Ohio has designed and built electrical transformers for Utility and Industrial use. As a matter of fact, we have a background of 50 years of transformer experience, for this firm was formed when the Packard Electric Company, who started building transformers in 1894, withdrew from the field. Key executives, engineers and workmen came with Standard, to continue here the manufacture of products with which they were thoroughly familiar. Thus, experience dating from the earliest days of transformer building is utilized.

Standard
TRADE MARK

TRANSFORMER COMPANY

Today Today, Standard offers a complete line of well designed, skillfully built transformers. Service records prove the economy and dependability of our products. An experienced engineering staff and a flexible manufacturing system enable us to provide transformers that meet your specifications. We will be glad to give you full details on any types in which you are interested. Write to the Company or nearest representative.

STANDARD TRANSFORMER COMPANY

WARREN, OHIO

Representatives in Principal Cities

★ ★ Makers of Transformers for: Distribution, Power, Metering, Street Lighting, Testing—Dry and Liquid Filled Types

The villain of this film threatens your plant, too!

FIRE, the saboteur, can destroy your plant — even though you've installed the most modern fire-fighting equipment! If your men don't know how to operate it, or if they use the "right" equipment against the wrong fire, disaster can easily result.

Believing that visual instruction is easiest understood, longest remembered, Walter Kidde & Company have produced a color film with sound. It shows exactly what to do when fire strikes. It pictures the different classes of fire, shows how to fight each of them. It's fast-moving, grips the attention of its audience during the twenty minutes of its run.

We'd be glad to show this film to key men at *your* organization. There is no obligation whatever for this service. Just drop a line today to the address below and we'll arrange a showing at your convenience.

WALTER KIDDE & COMPANY, INC., 140 CEDAR STREET, NEW YORK, 6, N.

Because of the basic importance of adequate wiring to the entire electrical industry, Anaconda is presenting messages like this in a wide list of national publications.

IT'S YOUR POSTWAR ELECTRICAL HOME

—See that it works!

THINK of your electrified home to come . . . big and little appliances of all kinds . . . advanced heating . . . air-conditioning . . . better lighting . . . television . . . All fine servants—but they will be handicapped if you give them insufficient electrical capacity.

So often electrical wiring plans are based on *past* electrical experience—a poor guide to the needs of peak loads to come. It's far safer to plan *reserve* capacity in line with the huge future increase in electrical usage. You'll save yourself plenty of grief later in breakdowns and expensive alterations.

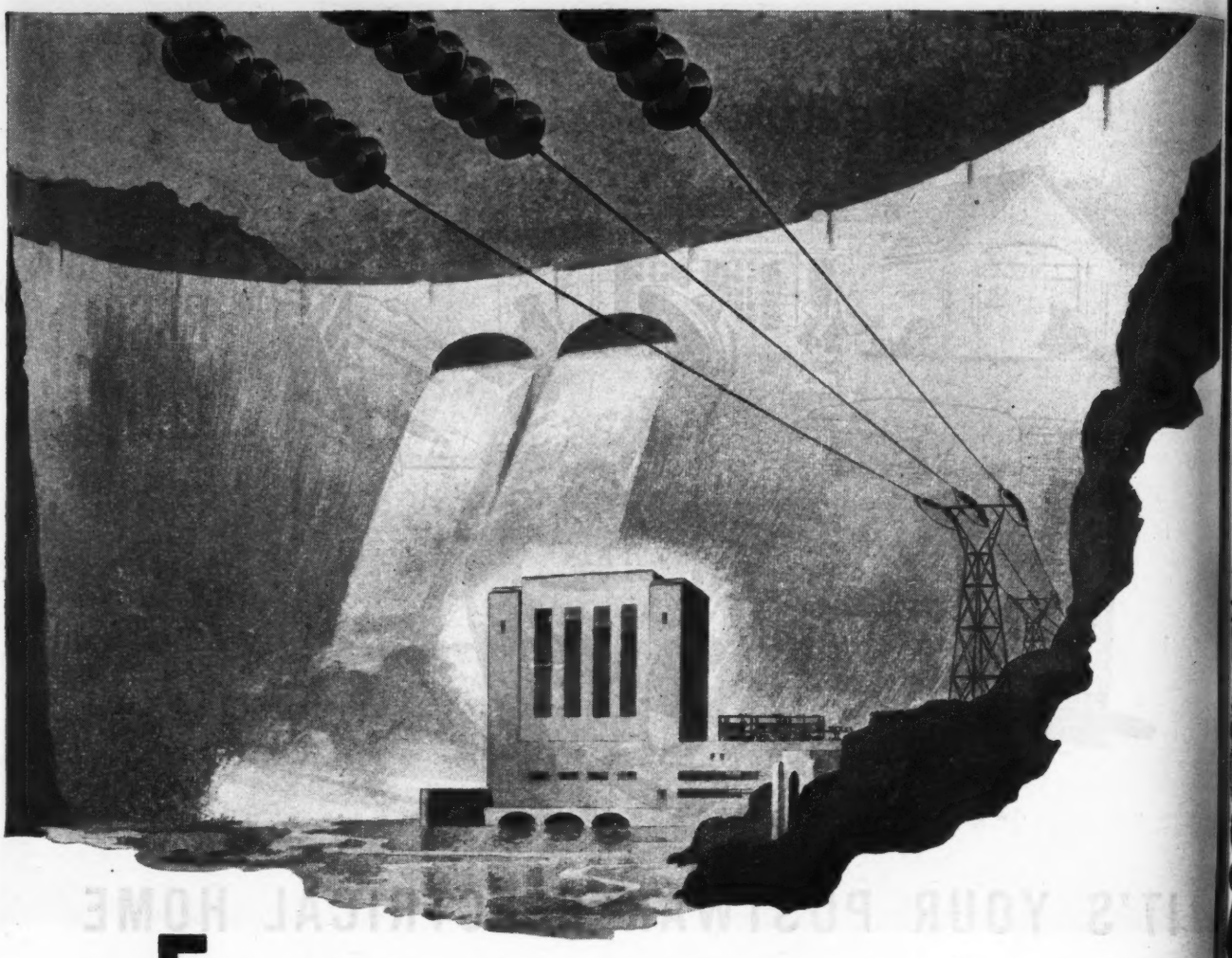
Manufacturers! Apply this in terms of industrial equipment in *your* business. The problem's the same. Make sure you have ample electrical capacity to meet the huge future increases in electrical usage sure to come. In plants too, planned wiring will cost a lot less than unplanned wiring.

Before structures get out of the planning stage, it will pay to consult electrical contractor, utility power engineer, plant power engineer. They'll agree that it's always wiser to *Wire Ahead!* 44255

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

It's Always Wiser to TELEGRAM WIRE TELEGRAM AHEAD



Exide Batteries

Ready to respond instantly with a mighty surge of power

Whether the load required is for closing or tripping switchgear, for continuous control bus operation, for emergency lighting, or other storage battery duties, Exides can be counted on to perform promptly and powerfully whenever the occasion demands.

Exide makes several types of storage batteries for control bus operation. These batteries have earned the confidence of engineers everywhere, and their widespread use in public utilities and private industrial plants is proof of their dependability, long-life and ease of maintenance.

Through more than half a century, Central Station engineers have learned that Exide Batteries assure the utmost in efficiency and economy . . . and that when they buy Exides they *Buy to Last.* By caring for them, they *Save to Win.*

Whatever your battery problems, Exide engineers will be glad to help you solve them.

ARMY E NAVY

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

Vinylite

TRADE-MARK

THOSE SUBMERGED CABLES mean light and communication to the deep sea diver—and their efficiency depends on water-resistant insulation. They typify the exacting service for which VINYLITE plastic wire and cable insulation is exceptionally well suited. It retains its excellent electrical characteristics though immersed in salt or fresh water during long periods.

Besides its high water resistance, VINYLITE plastic insulation gives the electrical field the advantages of unusual resistance to oils, grease, alkalies, chemical fumes, abrasion, and the deteriorating action of air and sunlight. It remains flexible at low temperatures. It can be made in a wide variety of colors. Certain types are non-flammable, others are slow-burning. Their thin-wall construction and high dielectric strength permit a greater number of circuits in existing conduits.

At present, VINYLITE plastic insulation is allocated 100 per cent to essential applications. When made available for general use, it will bring new reliability and service life wherever its water resistance or other properties are needed by public utilities, industrial and construction concerns, and marine, automotive, and aircraft manufacturers. Booklet 28-VR describes VINYLITE resin compounds for wire and cable insulation and shows their advantages for specific uses. Write Department **28** for your copy.

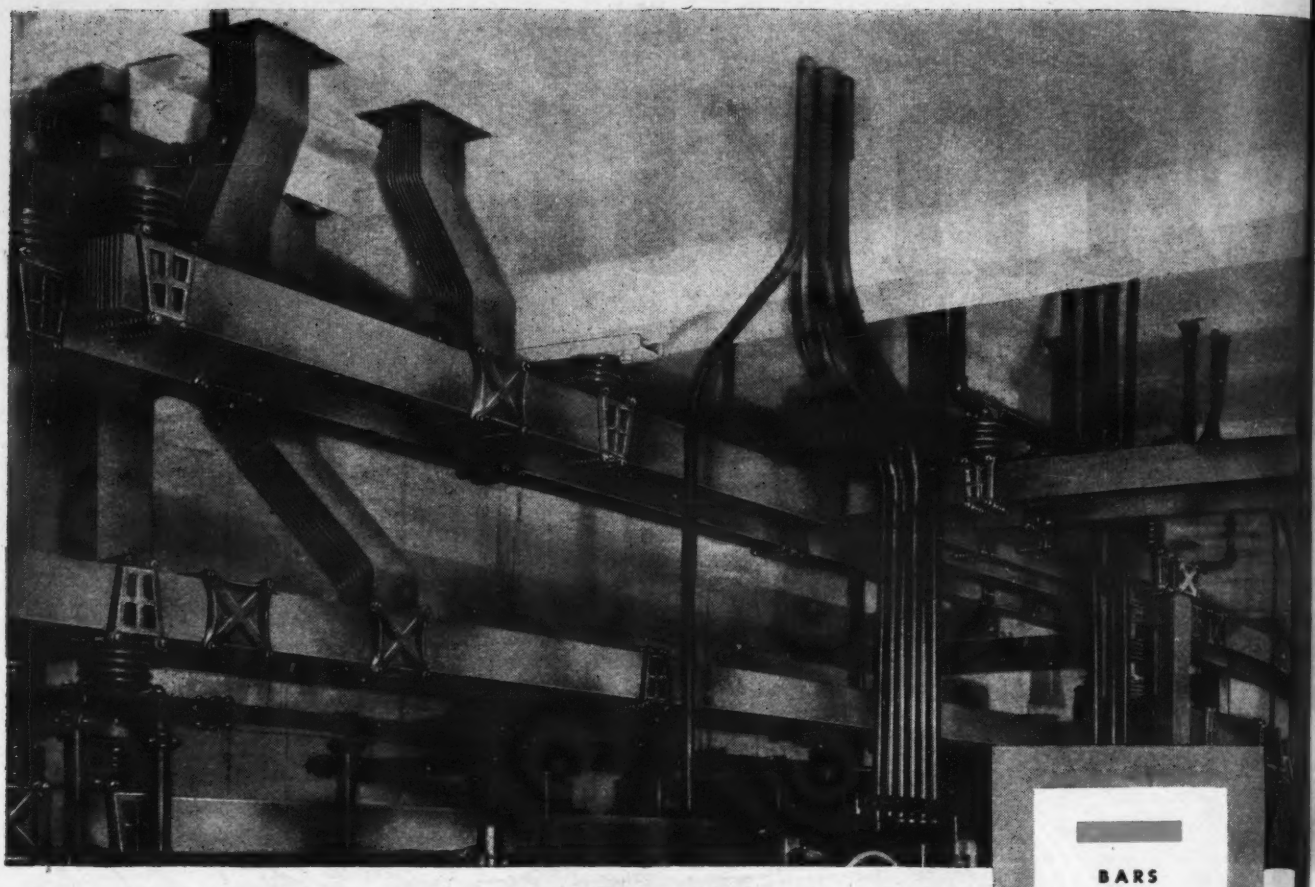
BAKELITE CORPORATION

Unit of Union Carbide and Carbon Corporation

UCC

30 EAST 42ND STREET, NEW YORK 17, N.Y.

Plastics



You can expect...

MORE EFFICIENT POWER TRANSMISSION WITH ANACONDA BUS SHAPES

WHEREVER modern electrical engineering practice requires bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the range of copper bus shapes made by The American Brass Company will meet every specification.

BARS—Require minimum space, may be bent or twisted, connected to apparatus without special joint preparation and in laminated construction have unlimited d.c. capacity.

TUBES—Provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS—Have large surface area, reduce temperature rise, provide greater rigidity than tubes for long runs and have flat surfaces for tap-off.

ANGLES—Are ventilated hollow busses with highest rate of heat dissipation, handle greater current density but require more space for installation.

CABLES—Solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as arc or resistance furnaces. 44217

Write for Bus Conductor Booklet C-25, or consult The American Brass Company Technical Department.

ANACONDA

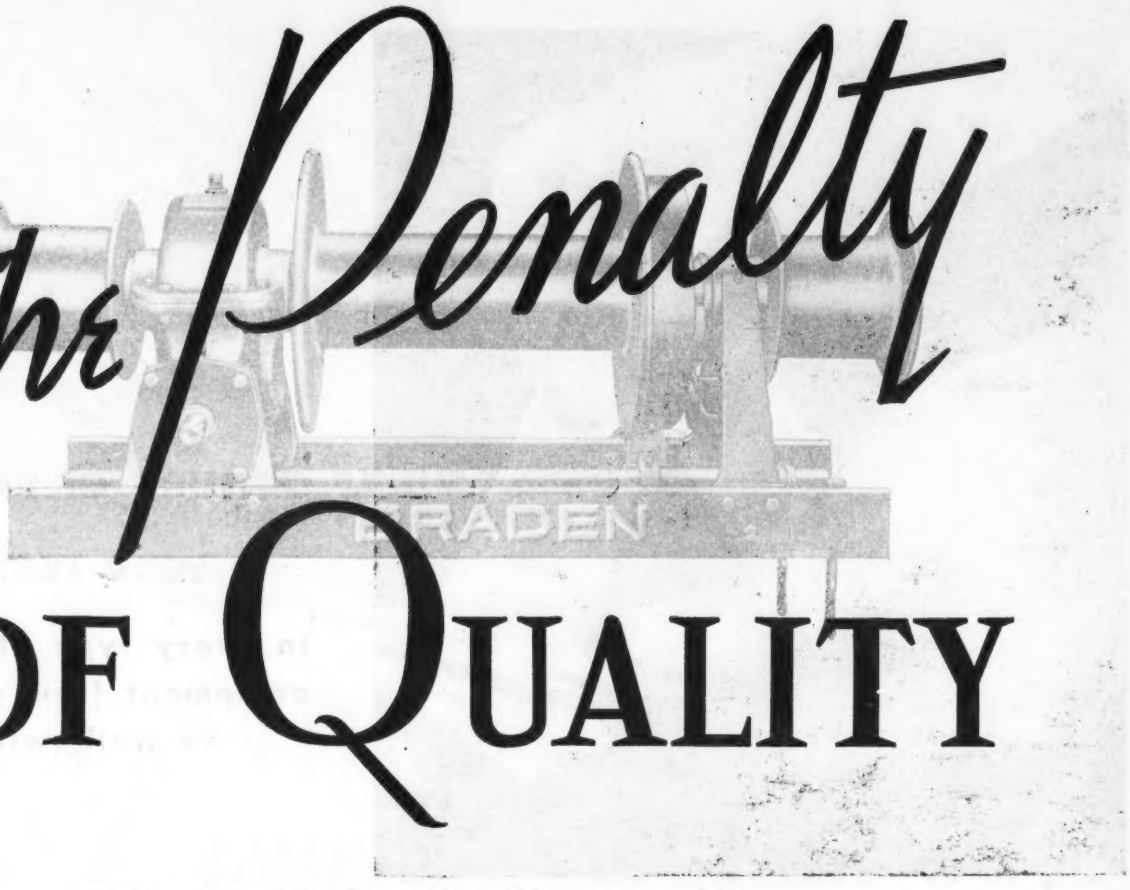
BUY MORE WAR BONDS

Anaconda Copper

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Co. • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

The Penalty OF QUALITY



THE quality of Braden workmanship has caused the government to call upon us more and more for winches designed to serve the war effort—we have been booked tighter on repeat orders than many of our competitors.

This is a tribute—one we deem it a privilege to merit—but we are paying a penalty for the traditional Braden quality in that many of our regular customers are having to go elsewhere for winches.

The victories of our armed forces foretell the day when we shall again serve you with as many Braden Quality winches as you need. We hope you will bear with us and understand the situation until this time arrives.

BRADEN WINCH COMPANY • TULSA, OKLAHOMA

Export Representative: M. N. Gomez, McBirney Building, Tulsa 3, Oklahoma

BRADEN

Buy Braden Winches — They Are Safer

OVER A HALF CENTURY OF PRACTICAL FIELD TESTS . . .

in every type of electrical equipment from generators to wall switches!

Can you use the services of an expert with 50 years' experience in testing, developing and specifying insulating materials?

Then specify the Westinghouse line of "Tuffernell" Insulating Materials. They're the result of *fifty years of field tests* with every type of electrical equipment.

This Westinghouse experience with all conceivable types of insulating materials has built up an authoritative file of exact application data. All of it is made available to you through Westinghouse Insulation Specialists. Call on them for help in your insulating problems.

Valuable material from this "insulation know-how" is now made available to you in the new Insulation Sample Book. This simplifies selection of varnishes, tapes, fabrics and papers *with actual samples*. Copies are available through your nearest Westinghouse distributor. Ask for B-3322. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

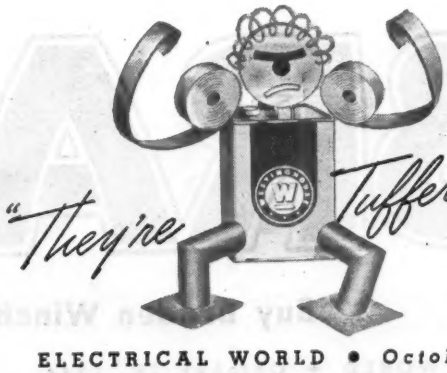
J-06358

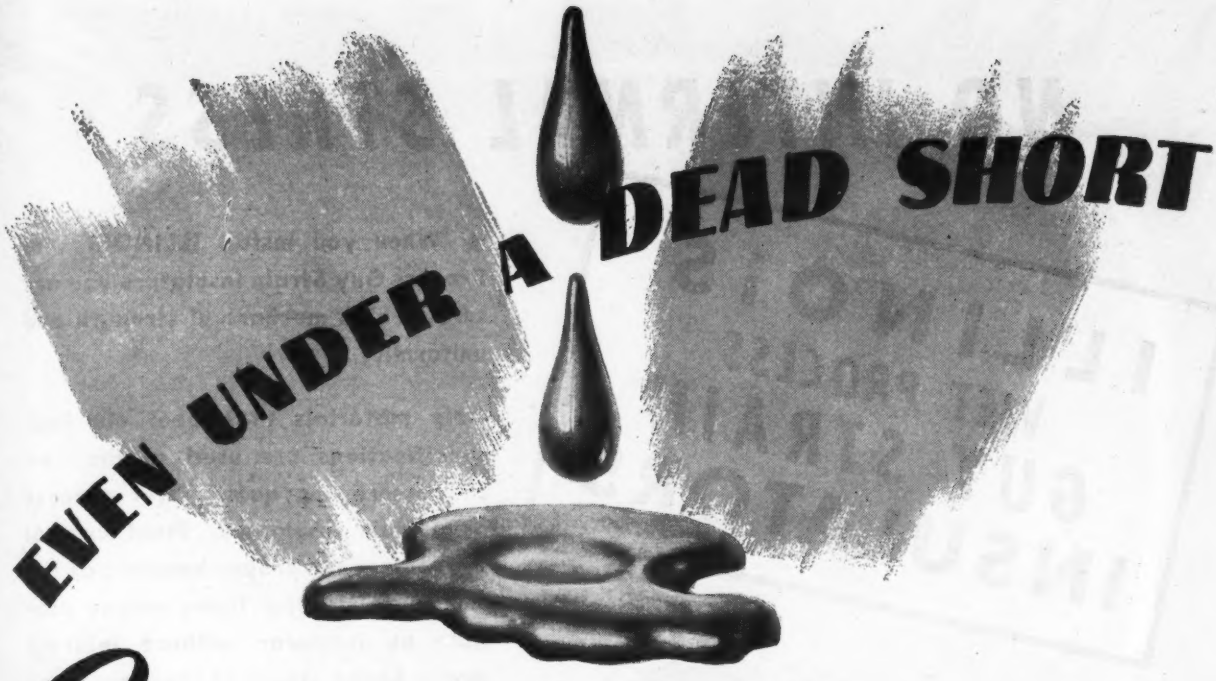
Hang up this new Insulation Sample Book for handy reference. It simplifies selection, ordering and application of Micas, tapes, fabrics and papers.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

INSULATING MATERIALS





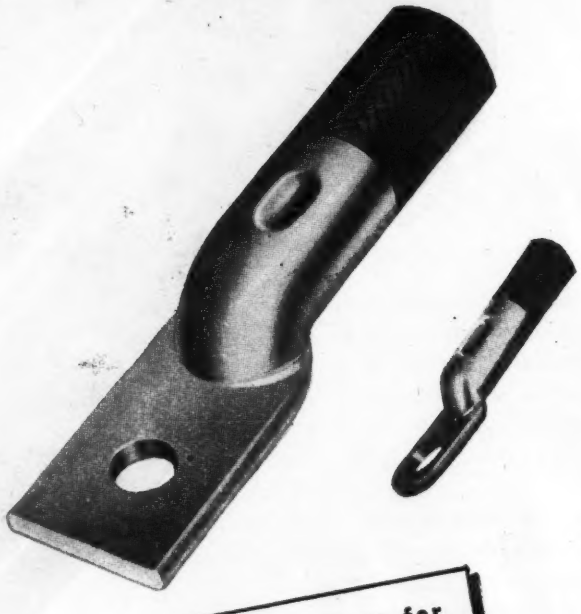
A HYDENT CONNECTION *Can't* LOOSEN OR MELT OUT!

The Burndy HYDENT connection is one point in the circuit that has caused no concern during this period of heavy overloads . . . when the "heat" really has been on. Being securely and permanently indented to the wire or cable with the Burndy HYTOOL, no loosening could occur even under a dead short!

It's this complete *freedom from worry about connector troubles* that has made the HYDENT connection so widely preferred not only by utilities and contractors but for electrical equipment as well. It provides a *permanent* connection, of high electrical efficiency, and it cuts installation time 50% to 90%.

HYDENT connectors, made in the form of lugs, links, reducers, taps, tees and crabs, are available for all wire and cable sizes. For complete information, write . . . Burndy Engineering Co., 107 Bruckner Boulevard, New York 54, N. Y.

IN CANADA: Canadian Line Materials, Limited, Toronto 13



Headquarters for CONNECTORS

Burndy

NO INTERNAL STRESS

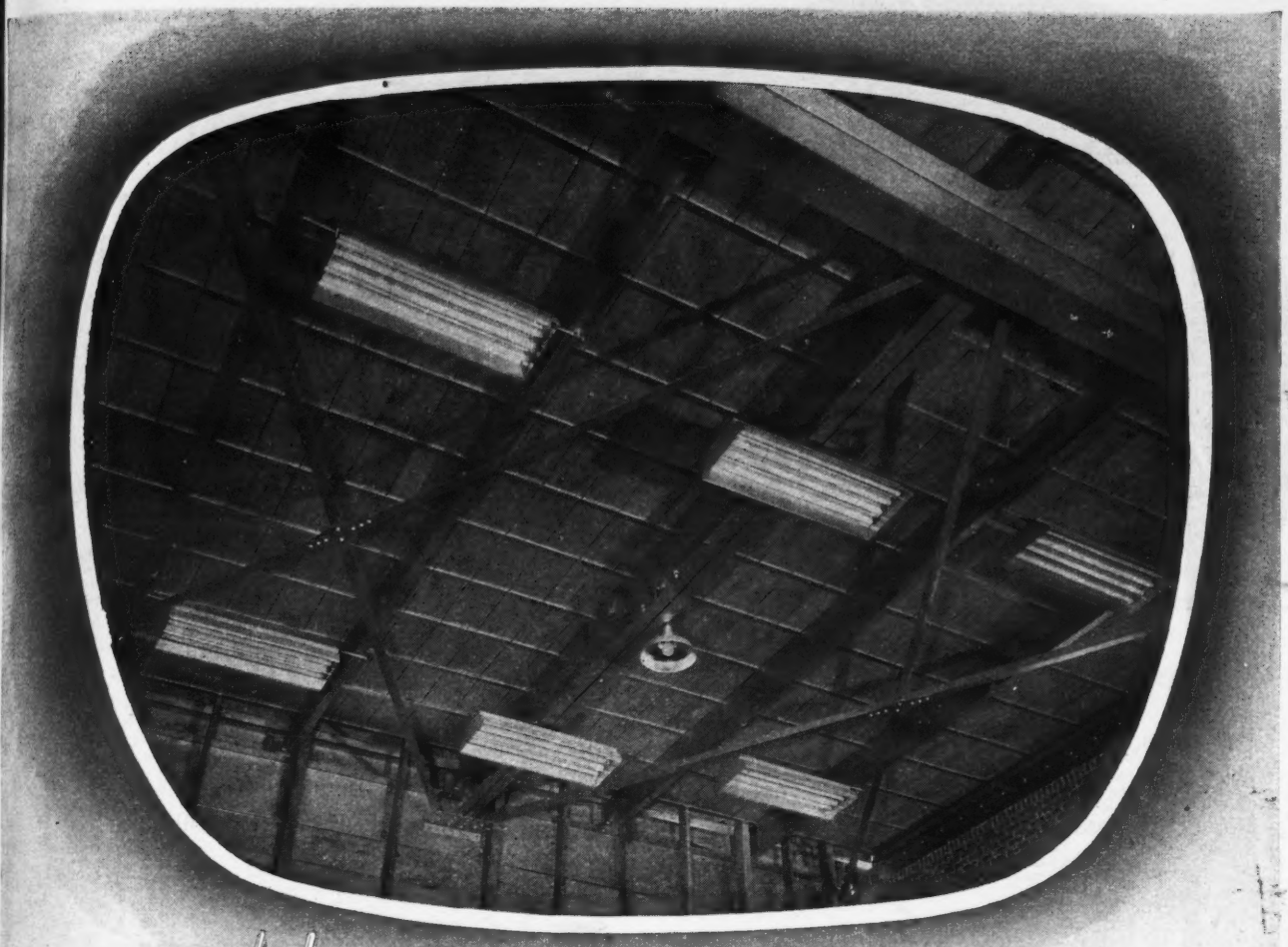
ILLINOIS WET PROCESS GUY STRAIN INSULATORS

★ When you install ILLINOIS Wet Process Guy Strain Insulators you are sure of high mechanical strength and uniformity.

Only materials that meet our high specifications are used so that we can assure top quality wet process guy strain insulators. Plant control guarantees the proper handling of the material—careful firing makes possible an insulator without internal stress. Large stocks of standard sizes are carried.

•NON-POROUS•• HIGH MECHANICAL STRENGTH
•HIGH DIELECTRIC STRENGTH •• EXACT DIMENSIONS and UNIFORMITY

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS



GETTING IT THERE IS EASIER WITH

Alzak* Aluminum Reflectors

On the question of manpower, manpower to install the lighting fixtures in a new addition or to relocate them as requirements change—the lighter weight of Alzak Aluminum Reflectors makes those jobs easier. It saves on man-hours to do the job.

Putting light where you want it, gaining valuable man-hours on production through better lighting, is a job which Alzak Reflectors do especially well. Reflector shapes are not dictated by material limitations. You can obtain bright, specular finishes or matte, diffuse surfaces, or combinations of the two.

Man-hours are again saved by the ease with which Alzak Aluminum Reflectors can be cleaned. Dusting or washing with mild soap and water often suffices to keep them working at high efficiencies. Other methods may be needed under more severe conditions. But the glass-like hardness of the Alumilite finish (process patented) makes cleaning easy.

Aluminum is now available for other-than-war purposes. Since the production of Alzak Aluminum Reflectors requires no increased manpower, you can substitute Aluminum for the metal you have been using in reflectors. Our representatives will gladly help you determine the facts. Write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Penna.

*Registered trademark

ALCOA ALUMINUM

LUMARITH insulation protects against the BLACK HAND OF CORROSION!

LUMARITH insulation is effective protection against electro-chemical corrosion even under severe conditions—for example, applications involving fine wire under conditions which ordinarily cause electrolysis, such as the presence of moisture and direct current.

Lumarith isn't subject to that built-in hazard of many types of insulation—organic decomposition. Lumarith resists moisture and contains no materials which combine with moisture to form free acids. It is outstanding for high dielectric strength, and its softening point makes it applicable for many types of coils.

Available in films, sheets, rods, tubes and molding materials. Films are supplied in plain or in special mat finish that reduces slippage and increases visibility for easier winding.

*Reg. U. S. Pat. Off.

LUMARITH
A Celanese Plastic

Send for "Lumarith for the Electrical Industry" a valuable reference booklet. Celanese Celluloid Corporation, a *division of Celanese Corporation of America*, 180 Madison Avenue, New York 16, N. Y.

LINE-ARC Contactor Control *for* BLAST FURNACE SKIP HOISTS

Offers these outstanding ADVANTAGES

1. Low initial investment.
2. Low stand-by renewal part inventory.
3. Low material and labor charges for upkeep.
4. Simplicity of construction—easily inspected.
5. Safe, flexible, smooth operation under all conditions of load.

● Pictured below is one of two duplicate installations recently placed in operation at two plants of a large steel maker. Purchaser had learned from experience with similar installations in other plants that EC&M Control Apparatus and Control Engineering rank at the top for this important primary step in steel making. Accurate records over a number of years showed this control to be safe, economical, and efficient.

Consult

Consult with our nearby office when considering control for Blast Furnace, Distributor-tops, Bell-hoists, Skip-hoists, etc.

THE ELECTRIC CONTROLLER & MFG. CO.

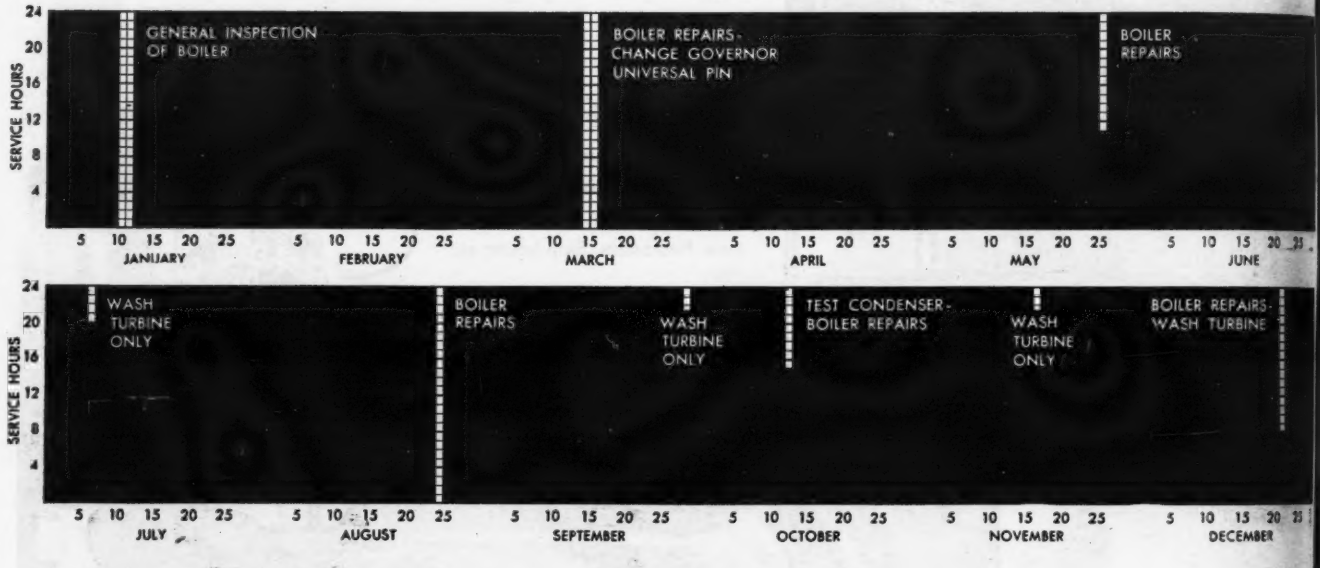
2698 EAST 79TH STREET — CLEVELAND 4, OHIO

In service 98%

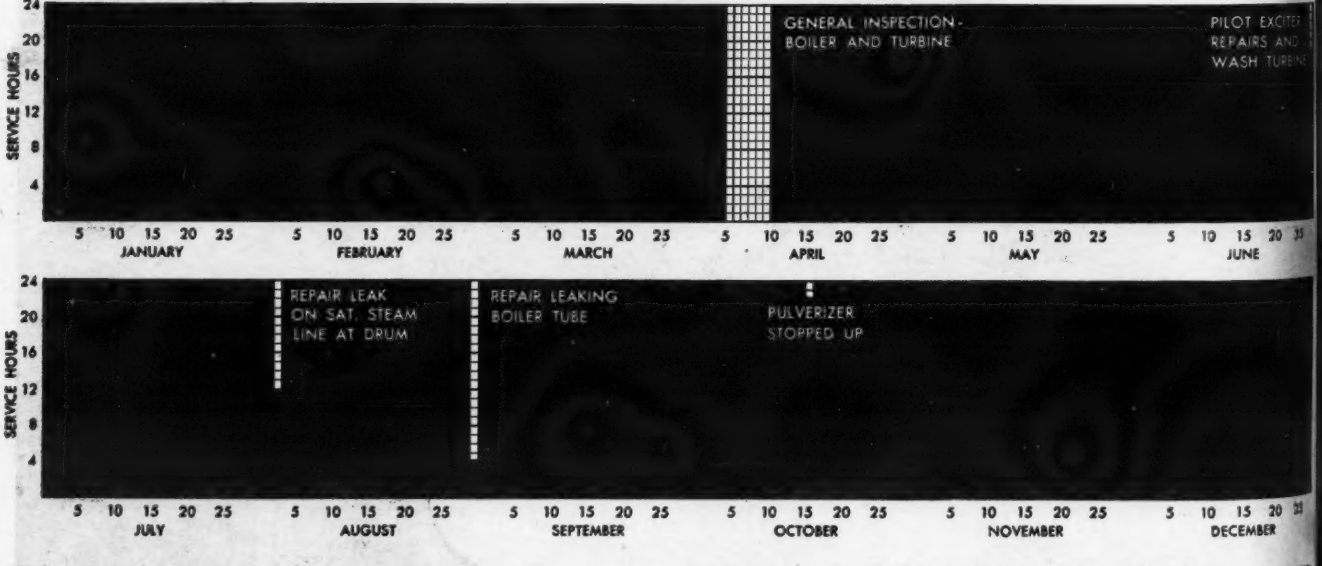
OPERATING RECORD

The outage charts below and on the opposite page provide graphic evidence of the fine operating record of a C-E Steam Generating Unit in the Cumberland, Md. plant of The Potomac Edison Company. This unit is designed to produce, at maximum continuous capacity, 312,000 lb of steam per hr at 840 psi and 830 F.

1941

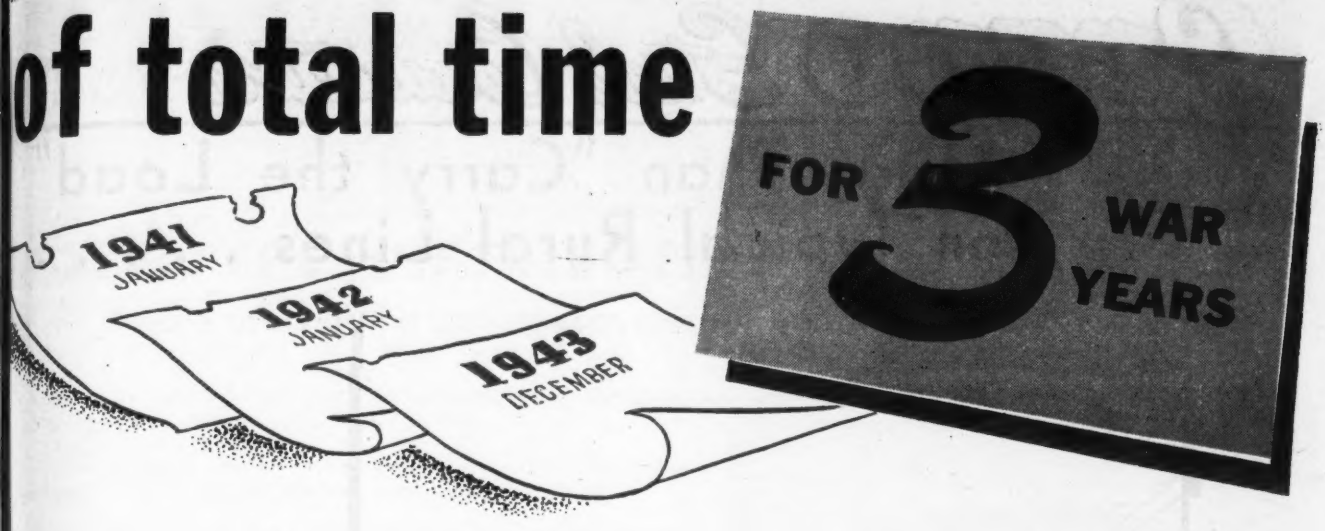


1942

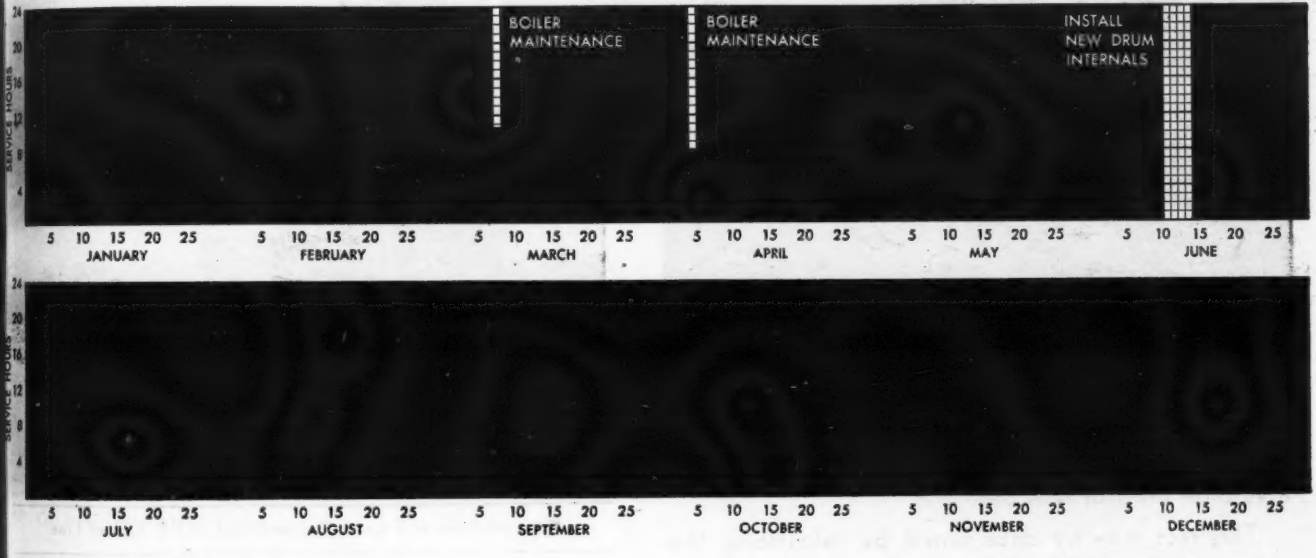


C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

# of total time



1943.



3 YEAR USE FACTOR 98.2%

During the three vital war years 1941, 1942 and 1943 this unit was actually on the line, 24 hours a day, 7 days a week for 98.2% of the entire period. If the brief scheduled outages for general inspection are excepted, the outage – forced outage – is about 1% for the three year period.

5½ YEAR USE FACTOR 95.5%

The unit was first placed in service in June, 1938. From that time until the end of 1943, a period of 5½ years, the unit was *in service* 95.5% of all the time.

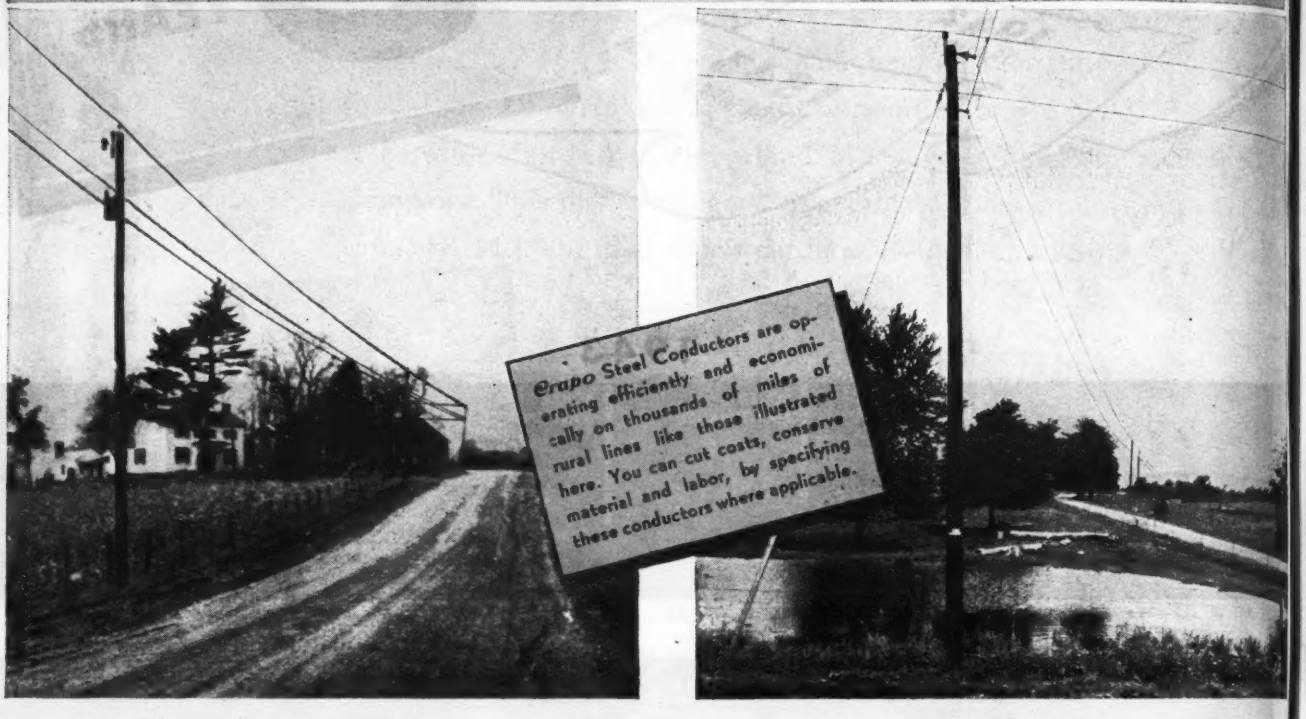
A-828

COMBUSTION ENGINEERING

200 MADISON AVENUE · NEW YORK 16, N. Y.

Crapo Steel Conductors

More Than "Carry the Load" on Typical Rural Lines . . . . .


Crapo Steel Conductors are operating efficiently and economically on thousands of miles of rural lines like those illustrated here. You can cut costs, conserve material and labor, by specifying these conductors where applicable.

Operating experience shows that the average loads on rural taps and branches do not exceed one kilowatt per mile. *Crapo* Steel Conductor will carry these loads, under normal operating conditions, with a voltage drop of less than 3%.

This fact may by determined by calculating the voltage drop of a typical line. Let's consider a single-phase, 6900-volt line (with 0.90 power factor) using No. 6 B.W.G. *Crapo* HTC-130 Stranded (3-wire) Steel Conductor. The line is to be 9 miles long with a uniformly distributed load of one kilowatt per mile.

To determine the kilowatt-miles, you multiply 9 miles (length of line) by 9 kilowatts (one kilowatt per mile for 9 miles). The result is 81 kilowatt-miles.

When a load is uniformly distributed along the line, the kilowatt-miles will be twice the kilowatt-miles for a load concentrated at the far end.

The 81 kilowatt-miles, in the example above, divided by 2 is 40½ kilowatt-miles. The accompanying table, based on kilowatt-miles with the load concentrated at the far end of the line, shows that for a 6900-volt single-phase line, with 0.90 power factor, the voltage drop for 40 kilowatt-miles is 2%. The voltage drop for 40½ kilowatt-miles will be approximately the same.

Kilowatt-miles of 6900-volt Single-phase and 12,000-volt Three-phase Circuits, No. 6 BWG *Crapo* HTC-130 Stranded (3-wire) Steel Conductor

(Copyright 1940 by Indiana Steel & Wire Company)

Kilowatt-Miles with Load Concentrated at Far End of Line

Power Factor of Load	Single-phase 6900 Volts†			Three-phase* 12,000 Volts†		
	1% Drop	2% Drop	3% Drop	1% Drop	2% Drop	3% Drop
1.00	21	42	63	126	253	379
0.90	20	40	59	119	237	357
0.80	19	38	57	115	230	344

† Voltages are those delivered at far end of line.
* Three-phase loads are balanced between phases

Crapo Steel Conductors combine superior 60-cycle alternating-current characteristics with a rugged tensile strength which makes for important overall economy. Ask representatives of Graybar Electric Company, Distributors, or write for Engineering Manual containing complete technical information about *Crapo* Steel Conductors!

INDIANA STEEL & WIRE COMPANY · MUNCIE, INDIANA

Here's Why

Wagner

POLE-TYPE DISTRIBUTION TRANSFORMERS

Assure users of the utmost convenience and economy of operation

1 Core and Coils of improved design and construction with high-quality materials give high efficiency and low operating costs.

2 Diagram nameplate gives full information. Nameplate pad extends below nameplate to provide space for attaching users' data.

3 Support lugs of heavy bar-iron electrically welded to the tank are designed for direct-pole mounting. Upper lugs are provided with two jump proof lips. When crossarm mounting is desired, T-crossarm hanger-irons can be bolted to these brackets.

4 High voltage pocket-stud-type bushings of wet-process porcelain are co-ordinated with the winding insulation of the transformers so that line surges will flash over the bushings on the outside of the tank. Clamp-type connector gives ease of connection. The porcelain bell extending over the connector provides added safety. High- and low-voltage bushings are securely clamped in position by a keeper-plate and spring.

5 Pocket is made of copper-bearing sheet-steel electrically welded to the tank.

6 Rotary-type ratio-adjuster dial extends above the oil level. A pointer clearly indicates the ratio connected.

7 Domed cover of extra-heavy, press-formed, copper-bearing steel.

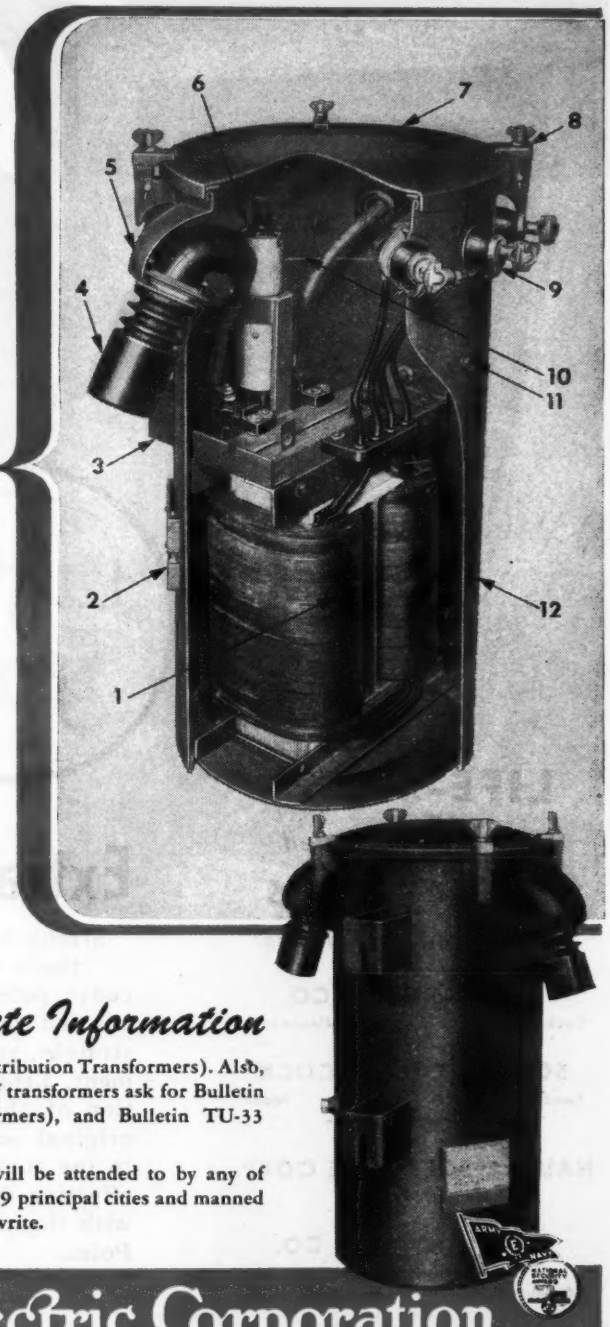
8 Cover clamping-assembly consists of a hot-galvanized wing-nut, bolt and clamp. The lower portions of the cover-clamps also serve as lifting-lugs on sizes 1½ to 10 kva.

9 Individual low-voltage stud-bushings of wet-process porcelain are properly coordinated with the winding insulation of the transformer. These bushings are of the removable type and are provided with solderless connectors.

10 Oil level clearly indicated.

11 Tapped pad suitable for attachment of solderless connector for grounding low-voltage neutral or for grounding of tank.

12 Tank is made of copper-bearing sheet-steel. Bottom is recessed to provide maximum protection while handling. Upper edge is rolled for added strength and to provide wide cover-gasket seat.



TRANSFORMERS
are but one of several
WAGNER PRODUCTS

Other WAGNER PRODUCTS:
AIR BRAKES
•
BRAKE LINING
•
HYDRAULIC BRAKES
•
INDUSTRIAL BRAKES
•
INDUSTRIAL BRAKE CONTROLS
•
TACHOGRAPH
(Recording Speedometer)
•
ELECTRIC MOTORS

744-15

Write for Complete Information

Ask for Bulletin TU-51 (Wagner Distribution Transformers). Also, if you are interested in other types of transformers ask for Bulletin TU-181 (Wagner Power Transformers), and Bulletin TU-33 (Wagner Noflamol Transformers).

Needs for immediate information will be attended to by any of Wagner's branch offices, located in 29 principal cities and manned by trained field engineers. Wire or write.

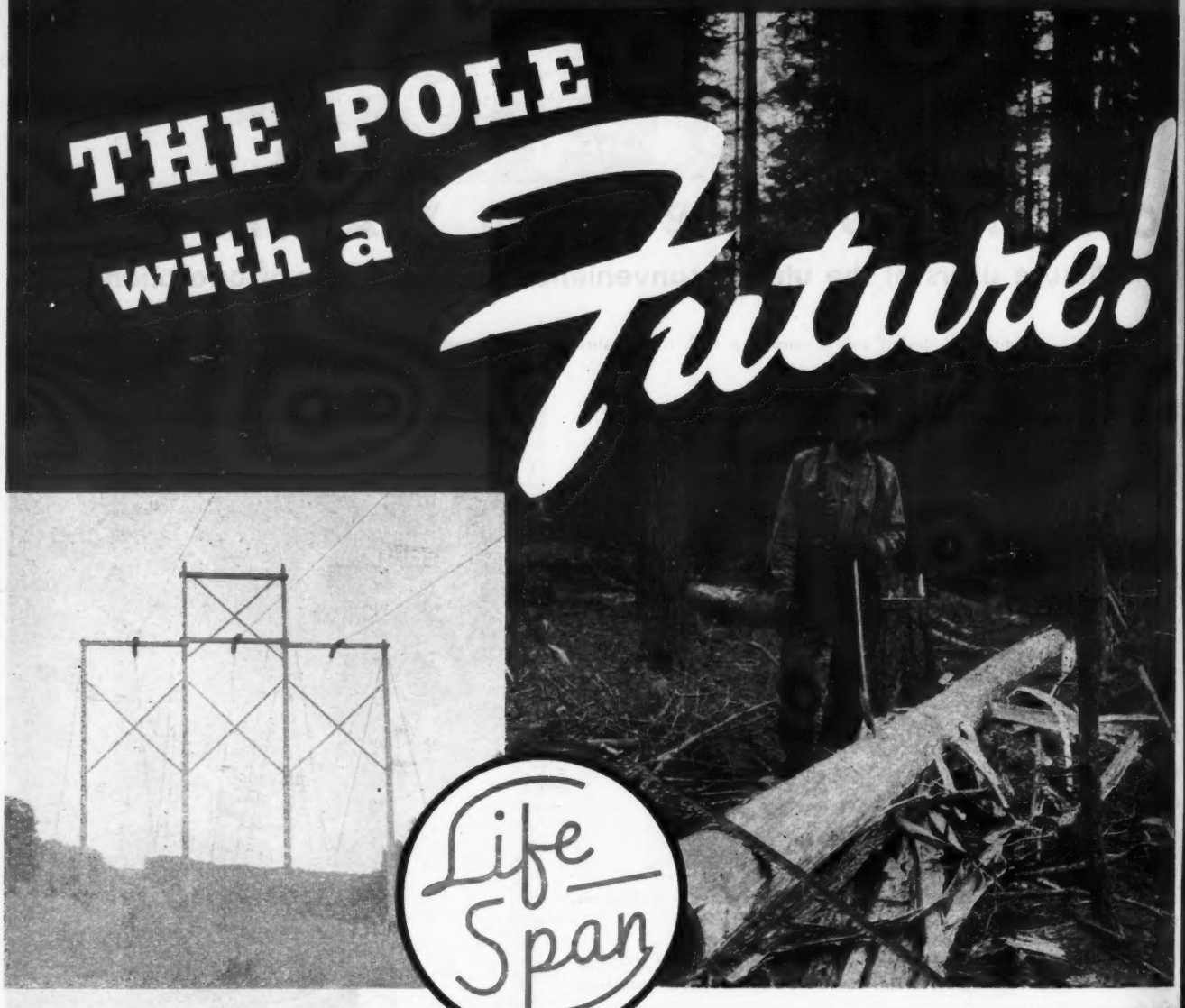
Wagner Electric Corporation

ESTABLISHED 1891

6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.

ELECTRICAL AND AUTOMOTIVE PRODUCTS

THE POLE with a Future!



LIFE-SPAN
Full-Length Treated
CEDAR POLES
Sold only by the following:

B. J. CARNEY & CO.
Spokane Minneapolis

SCHAEFER-HITCHCOCK
Sandpoint, Idaho
Suppliers for Joslyn

NAUGLE POLE & TIE CORP.
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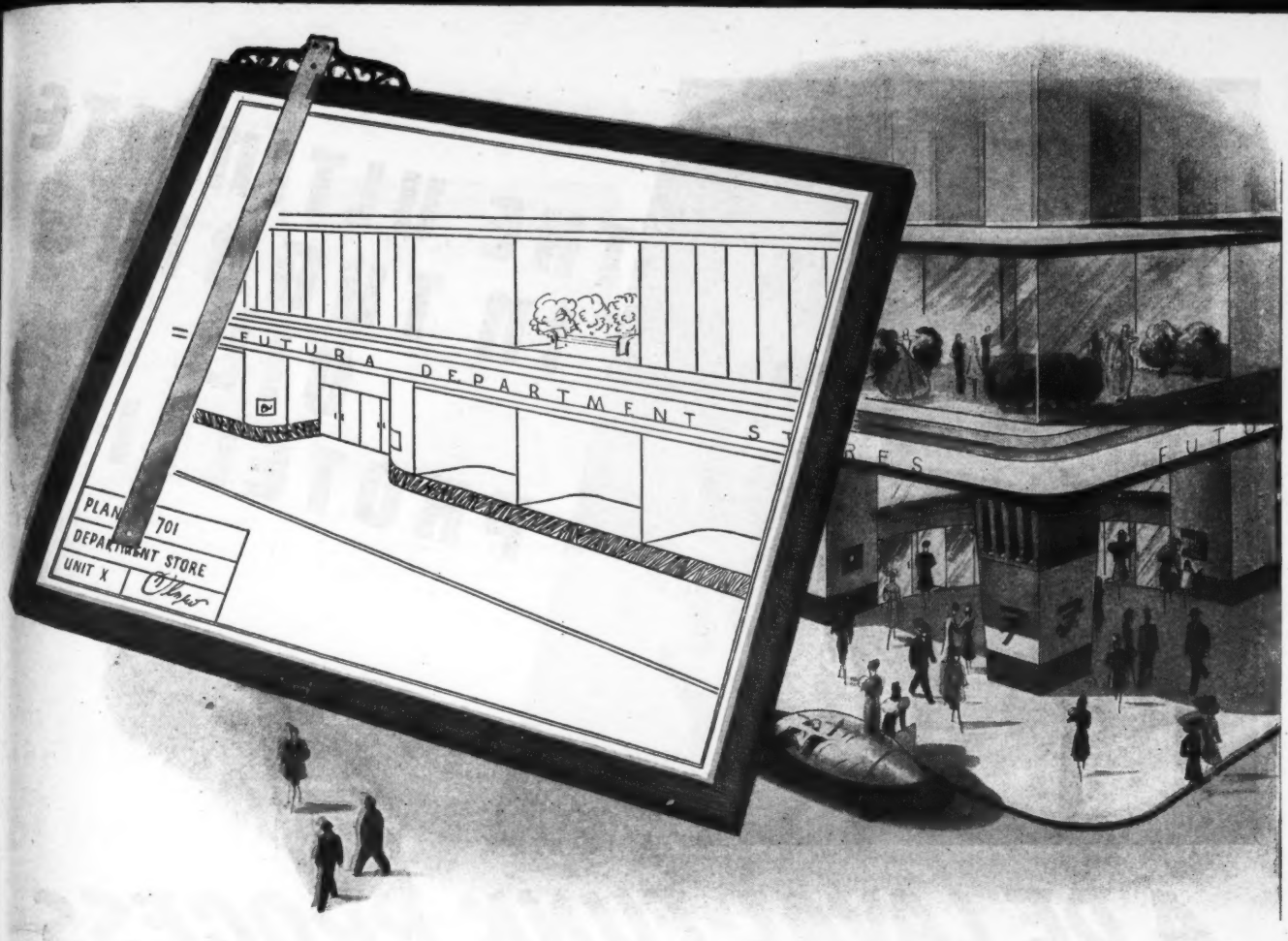
Extra Years of Sound Service

Strength and soundness that will last long years into the future . . . that's what the Life-Span full-length tox-i-tizing treatment of cedar poles assures. The application of pentachlorophenol has enabled science to add extra years to the normally long life of straight, strong, cedar poles. In addition to the regular butt treatment, Life-Span cedar poles are immersed in a highly toxic solution of this decay-resisting chemical. Tox-i-tizing preserves the original soundness of the sapwood, brings heartwood durability to the surface—top to butt. Tests show that the penetration and effective diffusion of this tox-i-tizing treatment actually *increase* with time. Get extra years of pole life. Specify Life-Span Cedar Poles.

CONSOLIDATED TREATING CO.
Minneapolis Minnesota



Tomorrow's No. 1 "Load Builder"

is on Engineers' Drawing Boards Today

Architects, engineers and contractors working as a team are today busily engaged in planning many air conditioning installations.

Executives of industrial plants, stores, theatres, hotels, hospitals, restaurants and buildings are placing it high on their list of postwar essentials. So, as a factor that will show the greatest increase in power demand, Air Conditioning assumes a No. 1 position.

With the increase in demand for this great power-consuming factor, many power companies are today providing for the handling of this tremendous additional power-user—Modern Air Conditioning.

Modern Air Conditioning means Westinghouse—and its years of pioneering research and engineering experience.

For essential war uses in factories, hospitals, airports, military bases, etc., Westinghouse Air Conditioning and Industrial Refrigeration Equipment is available today.

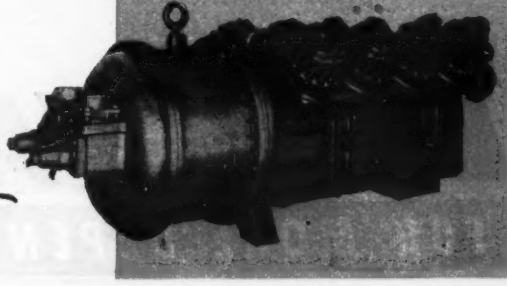
For executives, architects and engineers now planning postwar building and modernizing, dependable data and competent application engineering assistance are ready.

A new consumer booklet, "How To Plan Your Postwar Air Conditioning Today" will be helpful to commercial men when potential users ask their advice.

Phone your nearest Westinghouse office, or write on your letterhead to Westinghouse Electric Elevator Company, 150 Pacific Avenue, Jersey City 4, New Jersey.

HERMETICALLY-SEALED FOR DEPENDABILITY

Westinghouse pioneered the Hermetically-Sealed Compressor. Hermetically-sealed means light weight · small size · low maintenance and operating costs · high efficiency · long life.

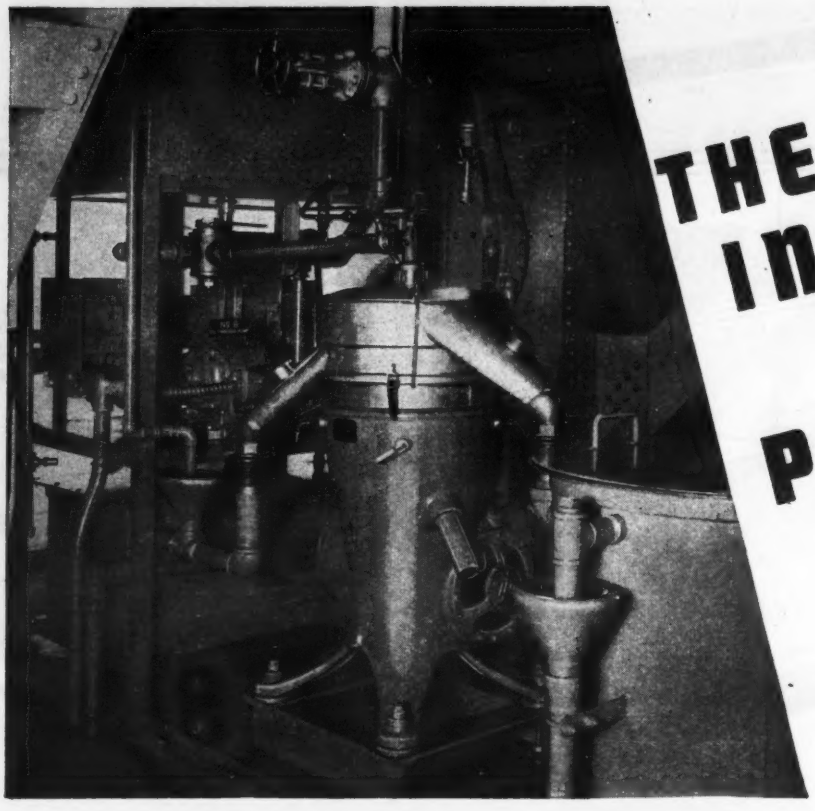


Westinghouse

PLANTS IN 25 CITIES . . OFFICES EVERYWHERE

Air Conditioning

Westinghouse presents *John Charles Thomas* • Sunday, 2:30 E.W.T., N.B.C.
Ted Malone • Mon. Wed. Fri. 10:15 E.W.T., Blue Net.



THE ULTIMATE IN TURBINE OIL PROTECTION

A DE LAVAL-FUNK PROCESS

THE De Laval-Funk Process is the "last word" in turbine oil protection because it is the most effective means of (1) minimizing the formation of sludge within the lubricating system and (2) continuously purifying the oil. As sludge is generally recognized to be the real trouble maker in turbine oil lubrication, the De Laval-Funk Process helps check trouble at its source. Moreover, since an adequate supply of clean oil is the best safeguard known against bearing trouble, the De Laval Centrifugal which is the purification unit of the Process provides the ultimate in protection against such failures.

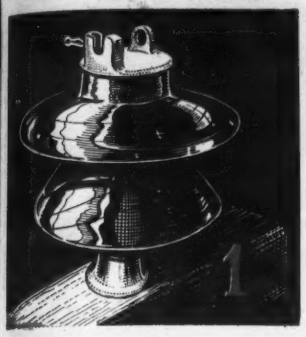
Whether the particular power plant calls for a De Laval-Funk Process or simply a De Laval Oil Purifier to keep the lubricating oil free from dangerous impurities and water, there is a wide range of capacities available from which to choose. Regardless of size or capacity, all De Laval Centrifugal Oil Purifiers maintain the oil in a condition most nearly identical with that of new oil, and make possible long, trouble-free service. Write for complete information.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL OIL PURIFIERS

FOR MORE DEPENDABLE POWER PRODUCTION

★ *It's as simple as this to install . . .*



Install the insulator minus the clamp just as you would install any ordinary pin type insulator.

Place the clamp on the conductor (on the ground) just tight enough to hold.

Locke CLAMP-TYPE *Insulators . . .*

Haul up conductor. Slide clamp into approximate position, drop it into the slot and drive the cotter key home.

As line is sagged, tighten the clamp bolts.

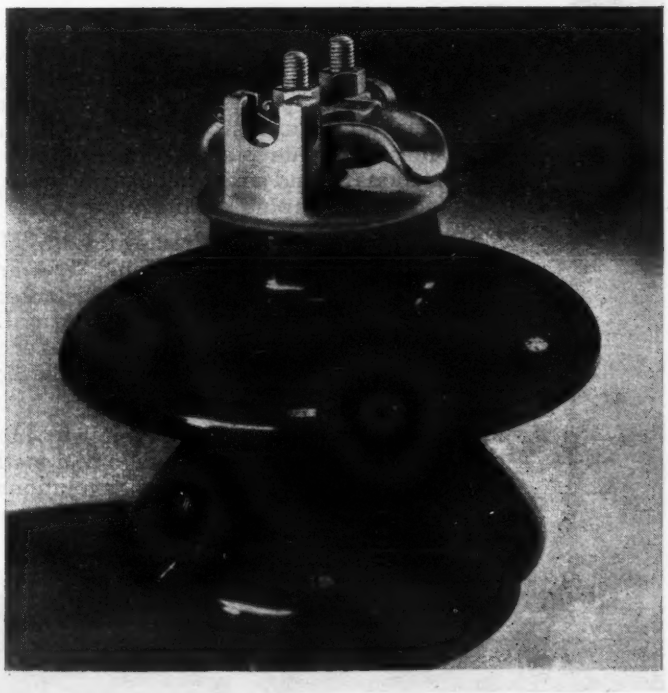
...and this is only one of the many exclusive advantages you get with these better pin-type insulators . . .!

LOCKE CLAMP-TYPES

- ✓ Eliminate radio interference permanently.
- ✓ Protect conductors against burning.
- ✓ Have no loose parts to handle in the air.
- ✓ Require no special tools to install or replace.
- ✓ Greatly simplified hot line maintenance.
- ✓ Eliminate resagging after replacement.

Only Locke Clamp Types give you all these advantages.

Before you decide on the insulators for your next construction job, be sure to get all the details on Locke Clamp Types.



LOCKE INSULATOR CORPORATION

BALTIMORE • MARYLAND

ORIGINATORS AND MANUFACTURERS OF BETTER INSULATORS FOR OVER 50 YEARS

FRINK-built frames help army radios over the rough spots

Radio apparatus going forward with the U. S. Army must travel over some mighty rough terrain. Trucks equipped with transmitters and receiving sets are provided with special frames to which the radio instruments are attached. Thus these delicate pieces of machinery are held stationary and are protected against the banging and bumping of uneven ground.

Many of the sturdy radio frames used in U. S. Army trucks are made by Frink. The Frink Corporation has specialized in precision engineering and manufacturing for 87 years. During that time the name Frink has become synonymous with quality and skill in the lighting industry.

Frink was instrumental in developing Incandescent lighting in the days when that method of illumination was considered revolutionary. Likewise The Frink Corporation has pioneered in the development of Fluorescent lighting. LINOLITE, the famous "engineered for vision" Fluorescent equipment, is a product of Frink designing and manufacturing skill. LINOLITE is now giving efficient and profitable service in many of America's foremost factories, stores and banks.

Today Frink is heavily engaged in war production. Tomorrow Frink will resume the designing and manufacturing of the high-quality lighting equipment that has gained such an enviable reputation in the industry.

LIGHTING SINCE 1857

Subsidiaries: Sterling Bronze Company, Inc.
Barkon-Frink Tube Lighting Corporation

★ ★ ★ ***All Frink employees invest at least 10% of their earnings in War Bonds*** ★ ★ ★

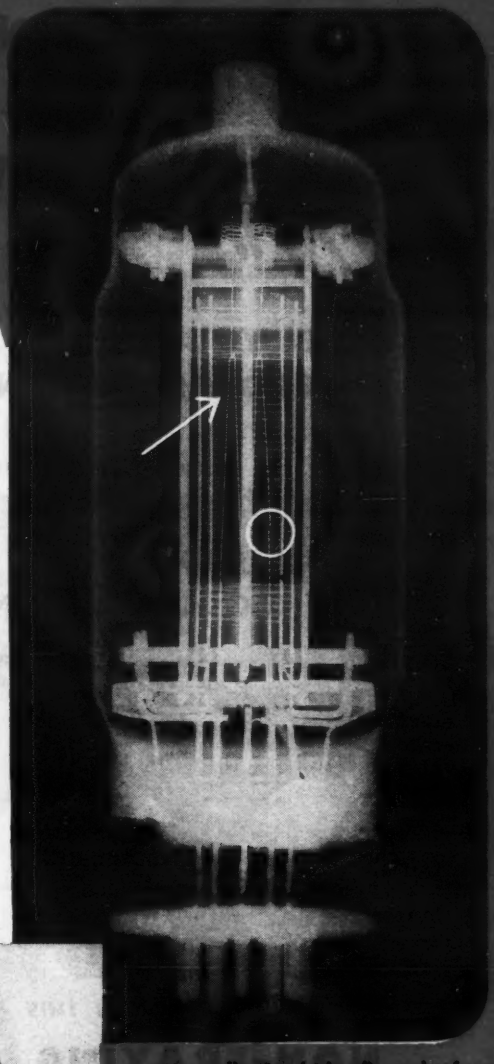
WE ARE PROUD OF THAT RECORD. LET'S ALL BUY WAR BONDS!

Why *Norelco* Tubes give uniformly high performance

INSPECTION by X-ray is only one of the many rigid tests applied to NORELCO electronic tubes. Misalignment of elements and similar internal faults, which cannot be seen by close visual inspection, may still permit a tube to function. Spot radiographic inspection by Searchray guards against such "invisible" defects creeping into production runs, thus assuring tubes of high performance and long life.

Typical of the thoroughness of our inspection methods on certain tests is the use of Searchray, the self-contained, rayproof, shockproof, easily operated industrial X-ray apparatus designed and developed by North American Philips. In keeping with this organization's traditional watchfulness over the quality of its products, we make our own X-ray tubes, as well as fine wire for tube manufacture and diamond dies for our own fine wire drawing. These many tests and exacting quality control are reasons why NORELCO electronic tubes, with their consistently uniform characteristics, high performance and long life, should be your choice for postwar industrial use.

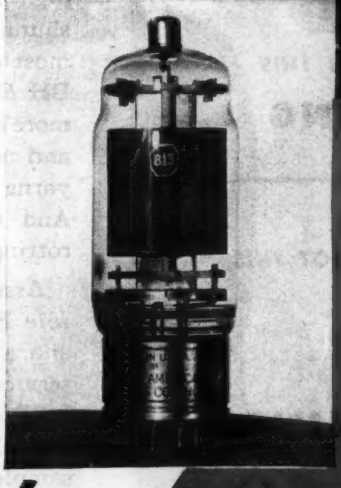
Although all the tubes we produce now go to the armed forces, we invite inquiries from prospective users. A list of tube types we are especially equipped to produce will be sent on request.



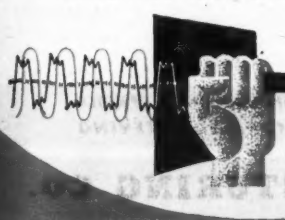
Unretouched radiograph of a defective NORELCO Type 813 tube taken by a NORELCO Model 150 Searchray, showing fractured filament and, on the left side, a misalignment of control and screen grids, as revealed through the surrounding graphite plate.

Let us send you our booklet telling the story of North American Philips. Behind this company is a team of outstanding electronic engineers, headed by one of America's leading physicists, and coached by a group with world-wide experience resulting from fifty years of research and development. Today we work for Victory; tomorrow, our aim will be to serve industry.

NORELCO PRODUCTS: Quartz Oscillator Plates; Amplifier, Transmitting, Rectifier and Cathode Ray Tubes; Searchray (X-ray) Apparatus, X-ray Diffraction Apparatus; Medical X-ray Equipment, Tubes and Accessories; Electronic Measuring Instruments; High Frequency Heating Equipment; Tungsten and Molybdenum products; Fine Wire; Diamond Dies.



A NORELCO Type 813 Beam Power Transmitting Tube.



When in New York, be sure to visit our Industrial Electronics Showroom.

Norelco ELECTRONIC PRODUCTS by

Reg. U. S. Pat. Off.

NORTH AMERICAN PHILIPS COMPANY, INC.

Dept. G-10, 100 East 42nd Street, New York 17, N. Y.

Factories in Dobbs Ferry, N. Y.; Mount Vernon, N. Y. (Metalix Division); Lewiston, Maine (Elmet Division)

NO FRAYED ENDS
NO FRAYED NERVES

WHEN YOU USE BH FIBERGLAS SLEEVING!

Here's an Insulation that Handles Easier, Cuts Cleaner and Saves Time

IF you're exasperated by ordinary sleeving that frays on the ends, works stiffly and doesn't hold up in use . . . then you'll certainly want the low-down on BH *Extra Flexible* Fiberglas Sleeving! For this is a really *flexible* and definitely *non-fraying* sleeving—built around the excellent insulating qualities of Fiberglas by an *exclusive* BH process.

Fiberglas, you know, is moisture-resistant, high in dielectric and tensile strength and is shunned by fungus growths and unharmed by most chemicals. "Punishment" tests prove that BH *Extra Flexible* Fiberglas Sleeving has even more advantages. It is *permanently* non-fraying and non-stiffening. It won't burn because both yarns *and* impregnation are non-inflammable. And it lasts indefinitely without cracking or rotting.

Assembly and repair men say BH *Extra Flexible* Fiberglas Sleeving is a pleasure to handle and a sure bet for long life in the most severe service. So why tolerate a less efficient sleeving any longer? BH is available in all standard colors and all sizes from No. 20 to ⅝", inclusive. Write for samples today and make your own comparison!

BH PRODUCTS

VARNISHED TUBING — SATURATED AND NON-SATURATED SLEEVING

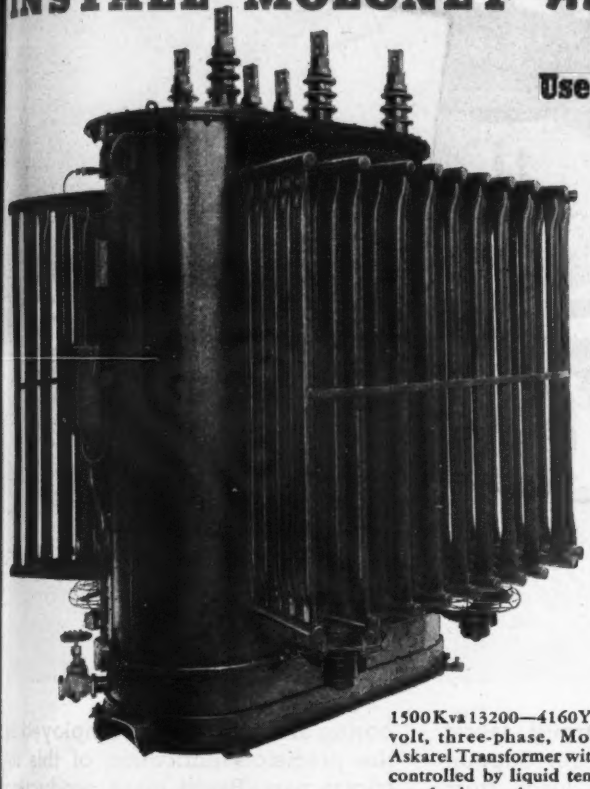
BENTLEY, HARRIS MANUFACTURING CO.

Dept. W Conshohocken, Penna.

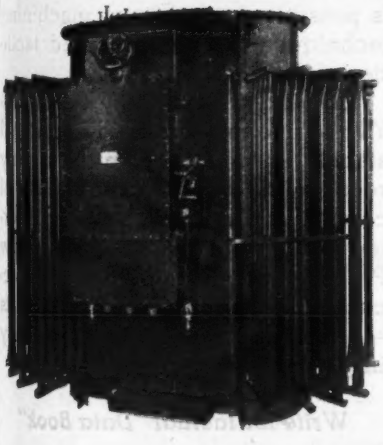
FOR *SAFETY* AND *ECONOMY*—

INSTALL MOLONEY *ASKAREL TRANSFORMERS*

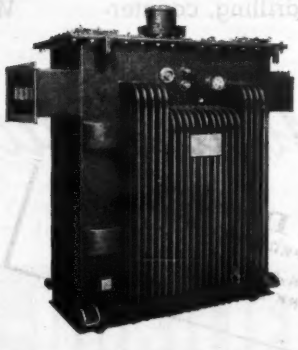
Used Where Non-inflammable Transformers are Required—Either Indoors or Outdoors



1500 Kva 13200—4160Y/2400 volt, three-phase, Moloney Askarel Transformer with fans controlled by liquid temperature for increasing capacity.



1000 Kva 2400—240 x 480 volt Askarel Transformer with HV selector type disconnect switch and terminal chamber equipped with two sets of cable connections to provide a preferred and emergency feeder to the transformer.



500 Kva 4160—208Y/120 volt, three-phase, sixty cycle, Askarel Load Center Transformer with throats for connection to primary and secondary switchgear.

MOLONEY Askarel Transformers are cooled and insulated with Askarel, a non-inflammable liquid. Because of this fact, these transformers are suited to use in applications where oil-cooled transformers would be hazardous to life and property.

Askarel Transformers are ideally adapted to indoor installation in hospital, school, hotel, theatre, office and apartment buildings—in industrial plants, mills and in central stations. They are of weatherproof construction and may be used in outdoor installations. These include in mines, on roofs of buildings, in street and sidewalk vaults for a-c network systems and many other applications where oil-cooled transformers might constitute a hazard.

These transformers effect savings in initial installation costs due to the elimination of expensive fireproof vaults. By locating the transformers at the center of the electrical load, further economies are effected by eliminating long, expensive runs of secondary copper and by providing improved voltage regulation. Moloney Askarel Transformers are available in the same ratings as oil-cooled transformers.

☆ ☆ ☆

Askarel has been approved by the Underwriters' Laboratories for use as an insulating medium and the National Electrical Code permits the installation of Askarel filled transformers indoors without the necessity for providing a fire-proof vault.

MOLONEY ELECTRIC COMPANY
St. Louis, U. S. A.

MOLONEY ASKAREL (NON-INFLAMMABLE LIQUID-COOLED) TRANSFORMERS

PRECISION-FABRICATED TO 3 DECIMAL TOLERANCES

Final Inspection — Micrometer indicators used to compare finished PANELYTE Barrel Support Block with metal template upon which test block is mounted.

PANELYTE* Propeller Barrel Support Blocks Stand Grueling Strain Without Deflection!

Vertical Milling — 3" and ¾" radii on PANELYTE Barrel Support Block milled to tolerance of ± .001" as curved surface must fit exactly to inside barrel contour.

Mass-produced from strong, fabric base PANELYTE — Barrel Support Blocks transmit heavy loads from the barrel to the spider of the Hamilton Standard Propeller used on bomber and fighter planes. Precision-fabrication is essential to assure accuracy of part — and exact balance in delicately adjusted assembly.

Manufacturing tolerances on length of support seat (cut-out section) in PANELYTE Barrel Support Block and on outside radius, which mates with barrel, are held to a total variation of .003" + .001" and — .002". Twelve different machining operations, including band sawing, grinding, sanding, drilling, counterboring and milling, are employed in the precision-fabrication of this intricate part. Rapid mass production is possible through new machining techniques and the enlarged facilities of the PANELYTE Plant.

The ready adaptability of PANELYTE to fine machining, dimensional stability — and economy — highly recommend it for structural parts of complicated design. Our engineering staff will be glad to explain how Precision-Fabrication guarantees accuracy in the most intricate of parts — often saves man-hours and money in production.

Write for factual "Data Book"

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Mexico City, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS AND FABRICATED PARTS IN PAPER, FABRIC, WOOD VENEER, FIBRE GLASS AND ASBESTOS BASE LAMINATES

SATISFYING KILOVAR REQUIREMENTS OF LARGE LOCALIZED LOADS

with C-D capacitors in banks

In C-D Capacitor banks, many utilities have found the best answer to present demands for large blocks of reactive. Flexible, efficient and quickly installed, these C-D Capacitor banks will supply the required Kva with minimum delay and use of critical materials. Our engineers will be glad to discuss the advantages of C-D capacitor banks as applied to your specific problems. Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

ADVANTAGES OF C-D CAPACITORS

EXTREME FLEXIBILITY — Circuit arrangement permits the switching of corrective capacity to conform to load.

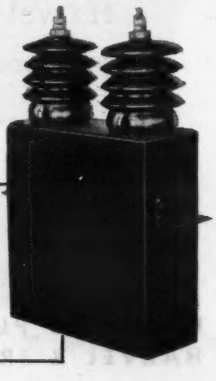
EXTREME MOBILITY — C-D Capacitors can be quickly removed to other locations to relieve sudden low power factor.

QUICKLY INSTALLED—Can be installed and put into operation in a fraction of the time required for other types of corrective equipment. Use less critical materials.

MAXIMUM EFFECTIVENESS — Capacitors are the most efficient reactive source and require a minimum of maintenance and attention.

A C-D CAPACITOR BANK INSTALLATION

Part of a large bank of 15KVA, 7960 volt Individual Outdoor Capacitors installed on 13,800 volt system at a Light Metals Plant.



15 KVA 7960 Volt
1 phase 60 Cycle
Individual Outdoor Capacitor

CORNELL-DUBILIER CAPACITORS

FOR POWER FACTOR IMPROVEMENT
CARRIER CURRENT COUPLING
SURGE PROTECTION

1910 – 1944

HARVEL 612-C

DOES NOT SUPPORT FUNGUS GROWTH*

Photograph illustrates the fungus resistance of Harvel 612-C Clear Baking Varnish. Note that the fungus culture of chaetomium globosum has not attacked the sample film of Harvel 612-C.

Fungus Resisting Properties protect electrical equipment

Electrical equipment operating in humid atmospheres, must be protected against the constant danger of the attack of fungus growth. This growth has been known to cause failure of electrical units within a few hours under severe tropic conditions.

Guard against fungus growth! Use Harvel 612-C Baking Varnish on component parts of radios, instruments, generators, motors, etc., and increase the life and usefulness of your equipment many-fold.

Where an air-drying fungus resistant varnish is desired, use Harvel 902-F. This type, like Harvel 612-C, does not support fungus growth.

Complete information and a free sample of either Harvel 612-C or Harvel 902-F varnish will be sent on request.

*Tested by the U. S. Testing Laboratories in accordance with A. S. T. M. Specification D684-42T.

IRVINGTON VARNISH & INSULATOR COMPANY
IRVINGTON 11, NEW JERSEY, U. S. A.
Plants at Irvington, N. J. & Hamilton, Ontario, Canada • Representatives in 20 principal cities

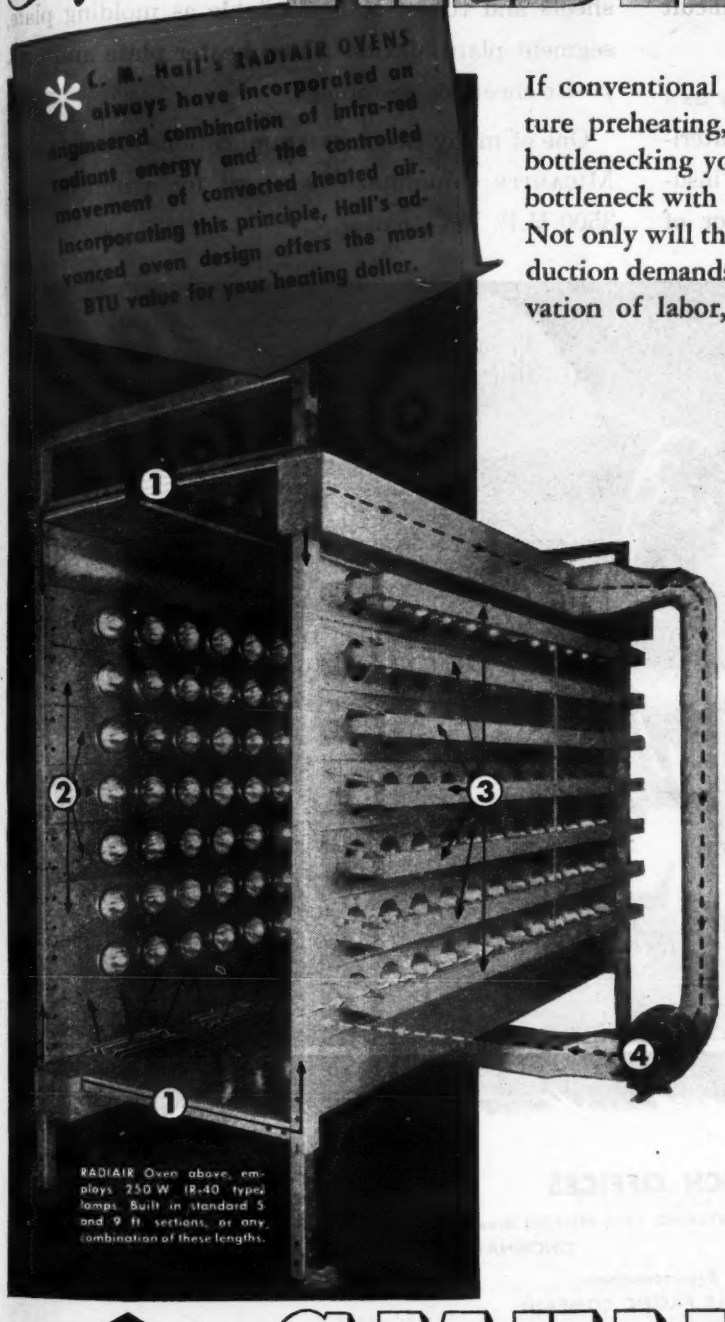
EXTRUDED PLASTIC TUBING • FIBRON PLASTIC TAPE • CARDOLITE RESINS
HARVEL & IRVINGTON INSULATING VARNISHES • VARNISHED INSULATIONS

Dry or Bake It FASTER

AT GREATER SAVINGS IN A

Hall *RADIAIR Infra-Red Oven

*C. M. Hall's RADIAIR OVENS always have incorporated an engineered combination of infra-red radiant energy and the controlled movement of convected heated air. Incorporating this principle, Hall's advanced oven design offers the most BTU value for your heating dollar.



RADIAIR Oven above, employs 250 W. IR-40 type lamps. Built in standard 5 and 9 ft. sections, or any combination of these lengths.

If conventional heating methods, involving the low temperature preheating, drying or baking of finishing materials, are bottlenecking your need for increased production—break that bottleneck with a tailored-to-fit-the-job Hall *RADIAIR Oven. Not only will this modern heating tool meet and beat your production demands, but the savings it effects in the efficient conservation of labor, space, materials and power will amaze you.

HALL *RADIAIR* OVEN FEATURES

Important for Money Reasons

1. **COMPLETE OVEN ENCLOSURE:** Coupled with highly developed air recirculation, makes fullest use of both radiant and derived convected heat. Positive temperature control insures faster, better drying, baking. Cuts power and operating costs.

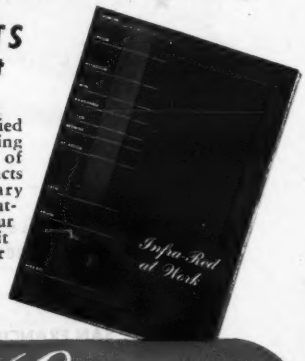
2. **PREFABRICATED PANEL CONSTRUCTION:** Makes for low installation cost—minimum maintenance upkeep. Can be fabricated to supplement or complement other heating facilities. Adaptable to processing wide range of work.

3. **VITAL PARTS OUTSIDE HEAT ZONE:** Wiring, lamp bases, sockets are enclosed in covered channels connected with control panel. Circuit breaking system controlling oven sections can be used to vary work temperatures—maintain different baking cycles. Accessibility of all vital parts permits fast, easy, safe servicing without interrupting oven operation.

4. **POSITIVE VENTILATION CONTROL:** Removes objectionable fumes and moisture from system—speeds drying. Equalized over-all oven temperature insures uniform, high quality baking results.

GET THE FACTS
on Infra-Red at Work

Available to all qualified users of industrial heating equipment. 28 pages of NEW up-to-the-minute facts about this revolutionary method of production heating. It's important to your business that you read it without delay. Write for your copy TODAY!



C. M. HALL LAMP CO.

C·M·HALL Lamp Company

PIONEER DESIGNERS AND BUILDERS OF INFRA-RED RADIANT HEATING EQUIPMENT

1035 EAST HANCOCK ST. **DETROIT 7, MICHIGAN**

Longer Life for Your

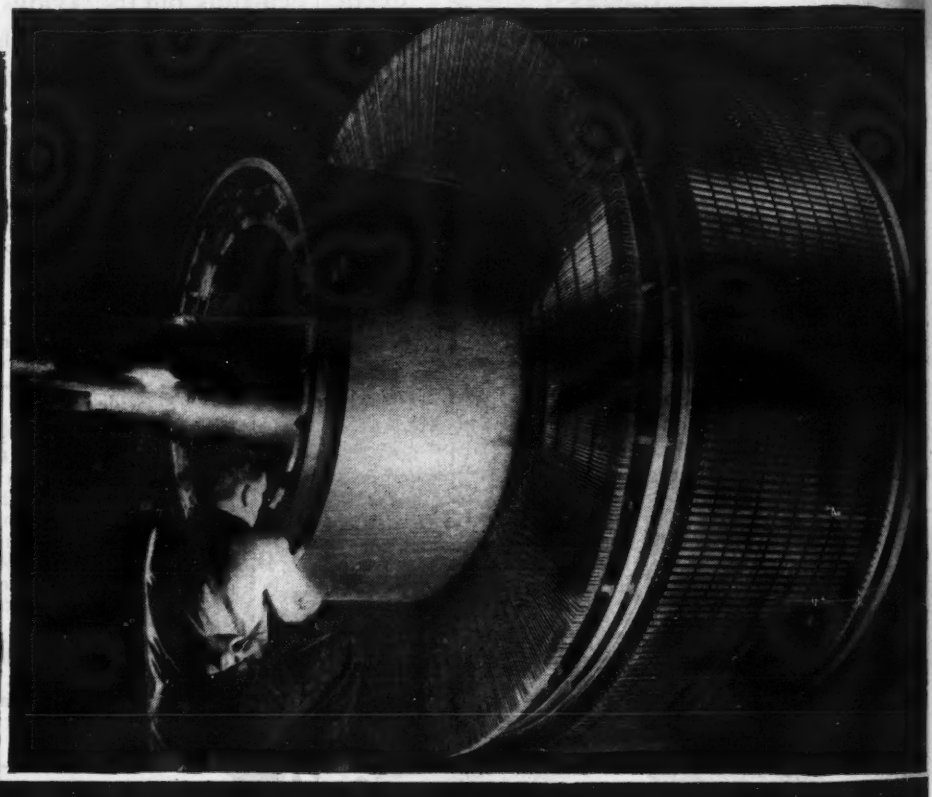
It is commonly admitted in designing electrical equipment, that insulation presents the most difficult problem of all the construction elements.

The facilities of the Mica Insulator Company as a single source for a great variety of insulating materials are available in the design and selection of insulation which will provide the necessary factor of safety under the higher operating temperatures, greater speeds and higher frequencies of today's electrical equipment.

Consultation with our engineering department while new products are in the blue print stage is your assurance of reducing insulation failures to the minimum.

MICANITE—the trademarked product of Mica Insulator Company—consists of thin Mica splittings bonded together into sheets and tubes. It is available as molding plate, segment plate, flexible plate, heater plate and composite sheets or wrappings.

One of many MICANITE applications is illustrated: MICANITE commutator segment for armature of a 3500 H.P. D.C. motor.



★

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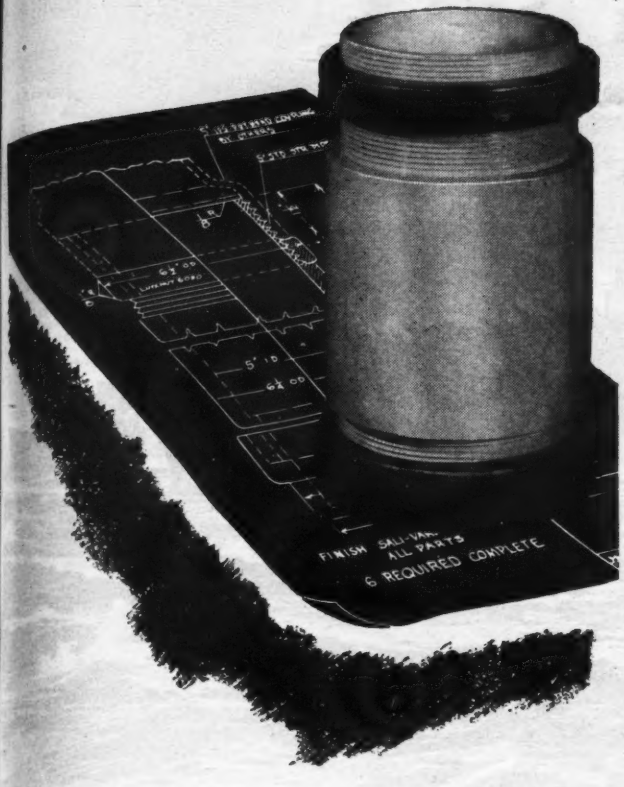
CHICAGO: 600 West Van Buren Street • CLEVELAND: 1276 West 3rd Street • DETROIT: Book Building
BOSTON: 285 Columbus Avenue • CINCINNATI: 3403 Hazelwood Avenue

Sales Representatives:
THE TRIANGLE PACIFIC COMPANY
SAN FRANCISCO: 1045 Bryant Str. • SEATTLE: 95 Connecticut Str. • LOS ANGELES: 340 Azusa Str.
BAKORING, INC.: 1020 Houston Avenue, Houston 10, Texas

MICA

Electrical Equipment



Specially designed insulating parts machined from LAMICOID plastic laminates meet mechanical and electrical specifications not possible to obtain with a less versatile material. Lightness, structural and dielectric strength—machinability that permits fabrication into simple or intricate shapes, and dimensional stability—all make it ideal for fabrications of parts like that illustrated at left.

In addition to Mica Insulator Company's own plant in Schenectady, New York, expert fabrication facilities are available through LAMICOID fabricators, strategically located in large industrial centers (see addresses below).

These plants maintain large stocks of LAMICOID sheets, rods and tubes, and offer prompt delivery of LAMICOID fabrications of all kinds.

Of particular interest is this new EMPIRE "3 mil bias tape" which combines extreme thinness with excellent dielectric strength and elongation properties. It is especially adapted for use on irregularly shaped conductors; or for solenoid and instrument coils.

The EMPIRE line also includes a complete line of varnished cloths and tapes and Varnished Fiberglas (for Class B insulation).

FABRICATORS

Mica Insulator Company, 200 Varick Street, New York 14, N. Y. • Insulating Fabricators Inc., 12 East 12th Street, New York 3, N. Y. • Insulating Fabricators of New England, Inc., 22 Elkins St., S. Boston 27, Mass. • Lamicoid Fabricators, Inc., 3600 Potomac Avenue, Chicago 51, Illinois • The Kirby Company, 13000 Athens Avenue, Cleveland 7, Ohio • Bakoring, Inc., 1020 Houston Avenue, Houston 10, Texas

INSULATOR COMPANY

200 VARICK STREET, NEW YORK 14, N. Y.

Electrical Weapons by the Maker of Bell Telephones

No. 2 of a series: *for the Navy*

One battleship needs as many telephones as a city of 10,000

When U. S. warships go into action, telephone equipment transmits orders instantly, clearly.

For the huge battleship "Wisconsin," Western Electric supplied two separate telephone systems using equipment designed by Bell Telephone Laboratories.

1. *Sound powered telephone system*—with 2200 instruments connecting all battle stations. These battle phones operate on current generated by *the speaker's voice*, so damage to the ship's electrical power supply cannot interrupt communications.
2. *Battle announcing system*—with 20 transmitter stations and over 300 loudspeakers which broadcast orders in a giant voice.

All this for just one battleship! Aircraft carriers, cruisers, destroyers, submarines, merchant ships too must have telephone equipment.

Today Western Electric—peacetime maker of telephones, switchboards and cable for the Bell System—is the *nation's largest producer of electronic and communications equipment* to aid our armed forces at sea, on land and in the air.

To speed Victory, buy War Bonds regularly—and hold on to them!

75TH ANNIVERSARY

Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT.

FWD

TRUCK POWER"

Helps Solve Shortages of Man-Power

No public utility attempts to get by with alibis. Regardless of handicaps of manpower shortage, over-worked equipment and restricted materials, industry and the public have got to be given service when they need it. Even in emergencies beyond ability of man to forecast, there can be no condoning of service interruptions.

FWD truck-power is a vital factor in helping utilities meet today's unprecedented demands. Old FWD trucks that have had long years of punishing service are proving that they still can "take it", in any weather, over any roads, or "off the beaten path", if necessary . . . because their ruggedness, power and traction in all four wheels, and natural all-'round adaptability to utility service go far beyond the limits of normal duty!

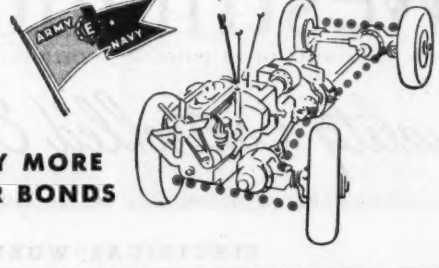
Big fleets of FWDs in service of over 150 utilities from coast to coast, have been proving for the past 30 years that they need no alibi in "following the job", regardless of location.

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wis. *Canadian Factory: Kitchener, Ontario*

One of Wisconsin Telephone Company's FWD Utility Trucks digs holes, sets poles, Fast . . . Saving Much Man-Power.

FWD TRUCKS

BUY MORE WAR BONDS



● *Oldest and original exclusive builders of Four-Wheel-Drive Trucks—famous for power and savings in tires, gas, oil, replacements.*

'STANDING "SERVICE RECORDS" IN COMMERCIAL—CONSTRUCTION—UTILITIES—

...a new tool of incredible speed and versatility...

The electronic tube may easily prove to be one of your most useful tools when you are confronted with reconversion headaches. Electronic tubes have proved that they save money in innumerable operations by increased speed and accuracy.

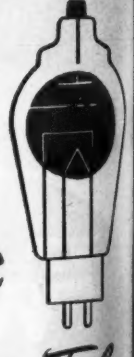
Take welding for example. For years resistance welding was limited to steel fabrication, permitting a considerable tolerance for electrode marking, discoloration and warping. Today—with the introduction of Westinghouse Electronic Tubes in welding and timing circuits—spot, seam, butt and projection welding is accomplished accurately, efficiently and quickly. This modern welding technique can be applied to stainless steel, aluminum and a wide variety of alloys in varying sheet thicknesses.

But—the use of electronic tubes is not confined to welding. In countless other applications such as heat treating, speed control, current regulations, conversion and measuring, they help do a better job.

For electronic devices you now have in service, or for new equipment you are planning, *always* specify and insist on Westinghouse Electronic Tubes—the tubes of assured uniformity and dependable performance.

QUICK LOCAL SERVICE ON INDUSTRIAL ELECTRONIC TUBES

Looking ahead to continued development of electronic equipment in industry, postwar, we now have a plan to make Westinghouse Electronic Tubes quickly and easily available. Stocks of the most widely used tubes are now available through Westinghouse Electronic Tube Distributors and Westinghouse District Warehouses. As rapidly as possible additional types will be added to local stocks to make a complete line of Quality Controlled Westinghouse Electronic Tubes available to everyone.

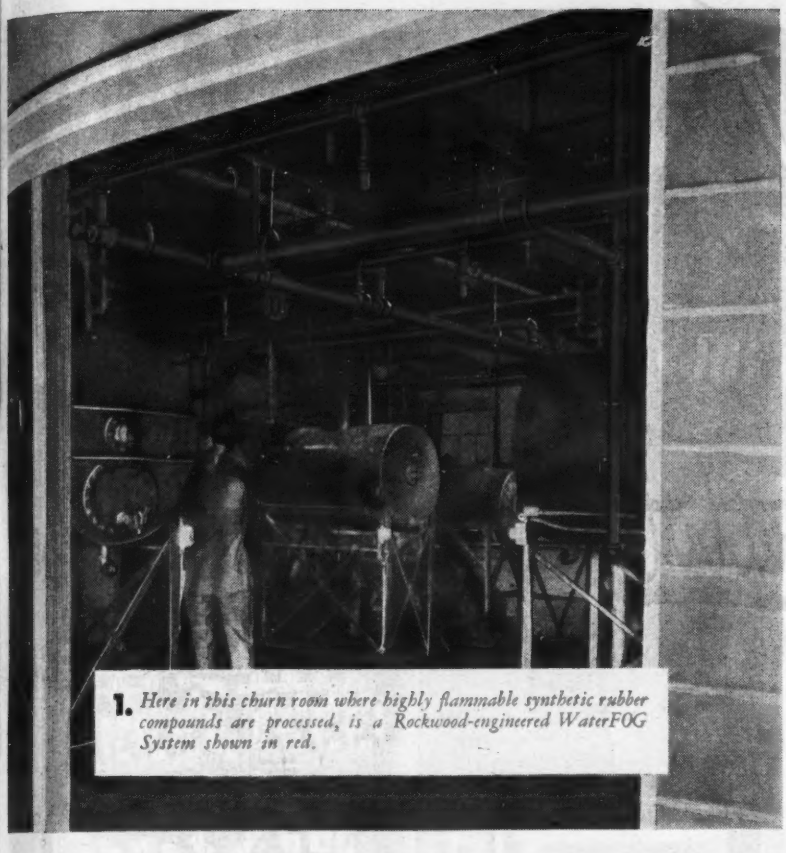


Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Quality Controlled Electronic Tubes

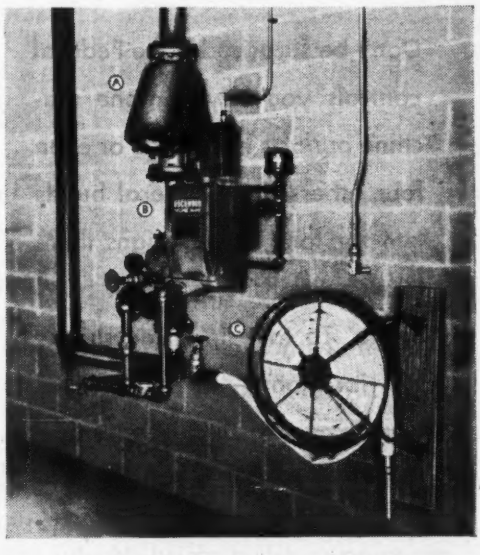
WESTINGHOUSE PRESENTS John Charles Thomas • Sunday 2:30 EWT., N.B.C. ★ Ted Malone • Monday, Wednesday, Friday—10:15 EWT—Blue Network



1. *Here in this churn room where highly flammable synthetic rubber compounds are processed, is a Rockwood-engineered WaterFOG System shown in red.*

2. *And this shows the Rockwood installation being tested. Notice how cooling, confining, smothering WaterFOG completely fills the room.*

3. *Here is the automatic control valve device which detects a fire and starts the fog. (A) Rockwood Strainwell Unit. (B) 2½ inch Rockwood Deluge Valve. (C) Auxiliary WaterFOG type N-22 nozzle, fire hose and hose reel.*



Why ROCKWOOD WaterFOG

SYSTEMS ARE SELECTED FOR CRITICAL WAR PLANTS

By impinging streams of water at a predetermined angle, Rockwood specially-designed equipment produces a most efficient WaterFOG pattern for fighting oil fires. Its myriad of tiny particles covers a broad area . . . ideal for places like the churn room above.

Every gallon of water changed to Rockwood WaterFOG absorbs about 8000 B.T.U's . . . remarkable cooling action for such a small amount of water. Then, as each gallon turns to steam, it occupies at least 230 cubic feet of space . . . choking off oxygen, snuffing out flames.

The most efficient installation of WaterFOG requires the specialized knowledge and background of Rockwood engineers. It is influenced by several important factors: the characteristics of the hazard itself, water supply, etc.

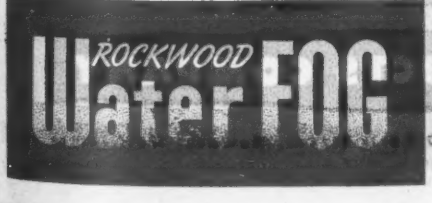
Rockwood-engineered systems in the form of fixed piping installations, approved by Underwriters' Laboratories and Associated Factory Mutuals. Nozzles and applicators for fire hose lines also available—used by Army, Navy, Coast Guard, U. S. Maritime Commission and hundreds of Industrial Plants. Write for Bulletin 123.

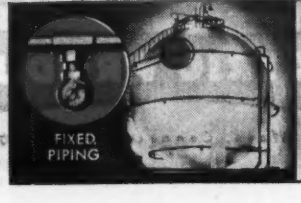
TYPICAL WaterFOG APPLICATIONS ARE:

transformers	generators
oil switches	paint shops
control rooms	oil storage, etc.

ROCKWOOD SPRINKLER COMPANY
62 Harlow Street, Worcester 5, Mass.
Specialists in Fire Protection Engineering Equipment and Installation since 1907

Water Engineered by Rockwood Cools, Confines, Smothers Oil Fires



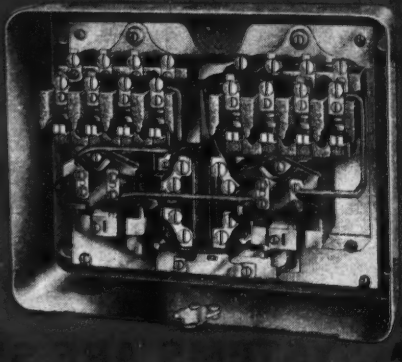


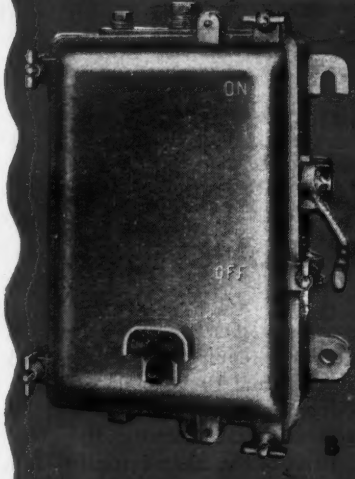
Federal

INDUSTRIAL CONTROLS

engineered to *outlast* the equipment they control

Don't be surprised if the Federal controls you buy for one machine *outlasts* two, three or even four others. For—Federal builds 'em for long life. Designs them to withstand the rigors of hard usage. To take in stride shocks . . . vibrations — or what have you. Expect to find, too, ample wiring space . . . easily removable contacts . . . efficient operation . . . ease and economy in maintenance. For safe and dependable control of motor-driven machinery depend on Federal.





A. Reversing magnetic starter Type "A" sheet steel cabinet

B. Combination motor starter Type "D" weatherproof cabinet

C. Manual Motor starter Type "A" sheet steel cabinet

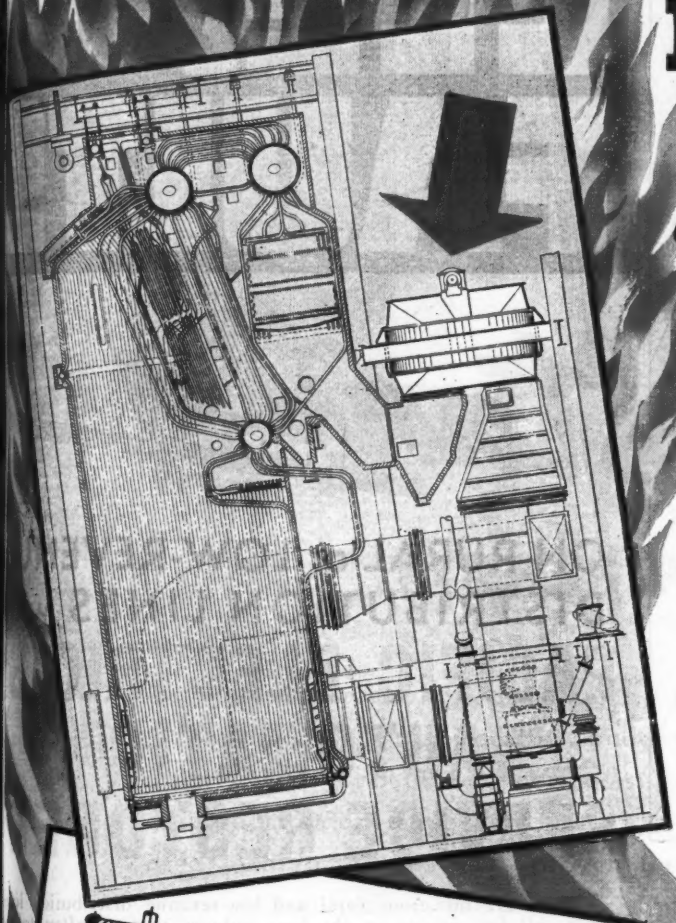
D. Magnetic Motor starter Type "U"—inside only

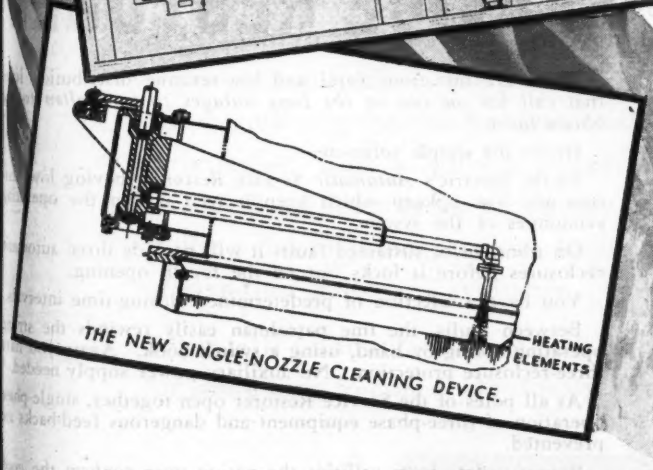
E. Push button station

FEDERAL ELECTRIC PRODUCTS COMPANY

Plants at: 1429 Park Street, Hartford, Connecticut and 80 Paris Street, Newark, New Jersey

NOW even better results from poor fuels with PREHEAT *Engineering*





THE NEW SINGLE-NOZZLE CLEANING DEVICE.

Problems presented by poor fuels hold fewer complications for boiler plants and industrial furnaces whose heat-recovery efficiency has been boosted by Preheat Engineering. High temperature combustion air is the key factor to efficient combustion of low-grade fuels with high ash and moisture content, and excessively lean fuels such as blast-furnace gas. In addition to economies effected by heat recovery, more efficient furnace design is made possible by preheated combustion air. It is a "must" for firing with pulverized coal.

ENGINEERING SERVICE

The engineering staff of The Air Preheater Corporation is prepared to assist you in applying the standard or special types of Ljungstrom Preheaters to your fuel conservation needs, or to help you convert your plant so as to get the most from low-grade, more abundant fuels.

The continuing decrease in fuel quality brings with it, in some cases, an unavoidable increase in deposit formation on the cold end of the preheater heating surface. To remove these deposits on the Ljungstrom, The Air Preheater Corporation has developed a new, single-nozzle cleaning device based on the mass blower principle. This high-efficiency cleaner has, for the past six months, kept a double-height preheater which was operated with exit gas temperatures below the dew point, completely free from the deposit formation.

Standard equipment on all new Ljungstroms, the new single-nozzle cleaner is available for immediate installation on existing units. You are invited to write for complete information.

THE
AIR PREHEATER
CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, New York

Yes, you can...

CLEAR FAULTS Instantly

ON RURAL or LOW-REVENUE DISTRIBUTION LINES with PACIFIC ELECTRIC'S AUTOMATIC SERVICE RESTORER

There are numerous rural and low-revenue distribution lines that call for *an end to the long outages that so often follow blown fuses.*

Here's the simple solution—

Pacific Electric's *Automatic Service Restorer* having low first cost and low upkeep which keep it well within the operating economies of the system.

On transient or sustained faults it will provide three automatic reclosures before it locks out on the fourth opening.

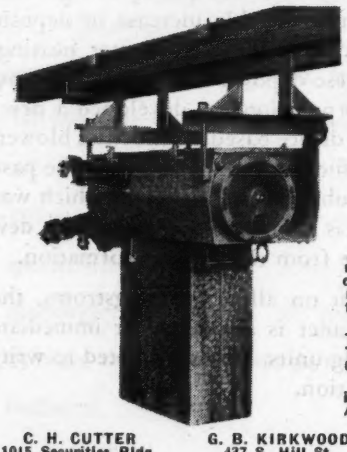
You have a selection of predetermined closing-time intervals.

Between faults, the line patrolman easily rewinds the strong operating spring by hand, using a switch hook. Again you have three-reclosure protection. No auxiliary power supply needed.

As all poles of the Service Restorer open together, single-phase operation of three-phase equipment and dangerous feed-backs are prevented.

Repeat orders from utilities the nation over confirm the good design, safety and sturdy long-lasting construction of this device.

Ask us for full details on instant clearance of faults on rural or low-revenue distribution lines.



ENDS Long Outages that Follow Blown FUSES

Type AP-1, Type AP-2 Hand-Wound

Operating energy is stored in a reliable spring, hand wound. It can be rewound between any faults. Has Position Indicator. Can be tripped by hand.

Type AP-1, 7.5/12.5Y-kv.; and Type AP-2, 15-kv.; Double- and Three-Pole Units, both 100 amps., 60 cycles.

Motor-Rewound Automatic Service Restorers also available, Type AP-40.

C. H. CUTTER
1015 Securities Bldg.
Seattle 1, Wash.

J. E. REDMOND CO.
448 W. Madison St.
Phoenix, Ariz.

G. B. KIRKWOOD
437 S. Hill St.
Los Angeles 13, Calif.

F. W. GORMAN
P. O. Box 223
El Paso, Texas

PIERCE G. FREDERICKS
90 West St.
New York 6, N. Y.

C. C. MUSGROVE
508 Insurance Bldg.
Dallas 1, Texas

Other Representatives in Principal Cities

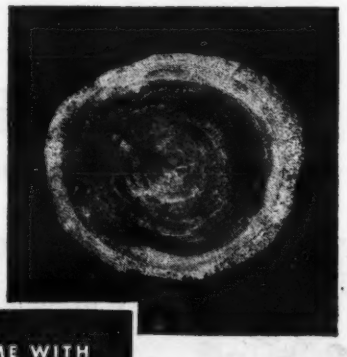
Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO 24, CALIF. P. O. BOX 419, GARY, INDIANA

OSMOPLASTIC
Reduces Costs
MAKES POLES LAST LONGER

Osmoplastic Ground Line Treatment will be provided for in many a Utility Budget for 1945. If it is not now in yours, consider these important facts: More than a hundred leading utilities have proven the value of Osmoplastic treatment; During 1944, authority for the treatment of approximately half a million poles was issued; Basic records for accurately controlling the maintenance and treatment of standing poles are available.

Poles will undoubtedly remain "tight" for some time to come. Obviously, then, Osmoplastic Ground Line Treatment is the simplest and safest solution. Consult us at once; we are prepared to assist from the planning stage to the finished job. Save time, material, poles and money. Write Osmoplastic into your '45 budget.



PROOF OF THE PUDDING! Save the groundline and you save the pole. The white area of this pole cross-section, shows the penetrating action of the toxic chemicals in Osmoplastic.

MAKE INSPECTION TIME, PROTECTION TIME WITH

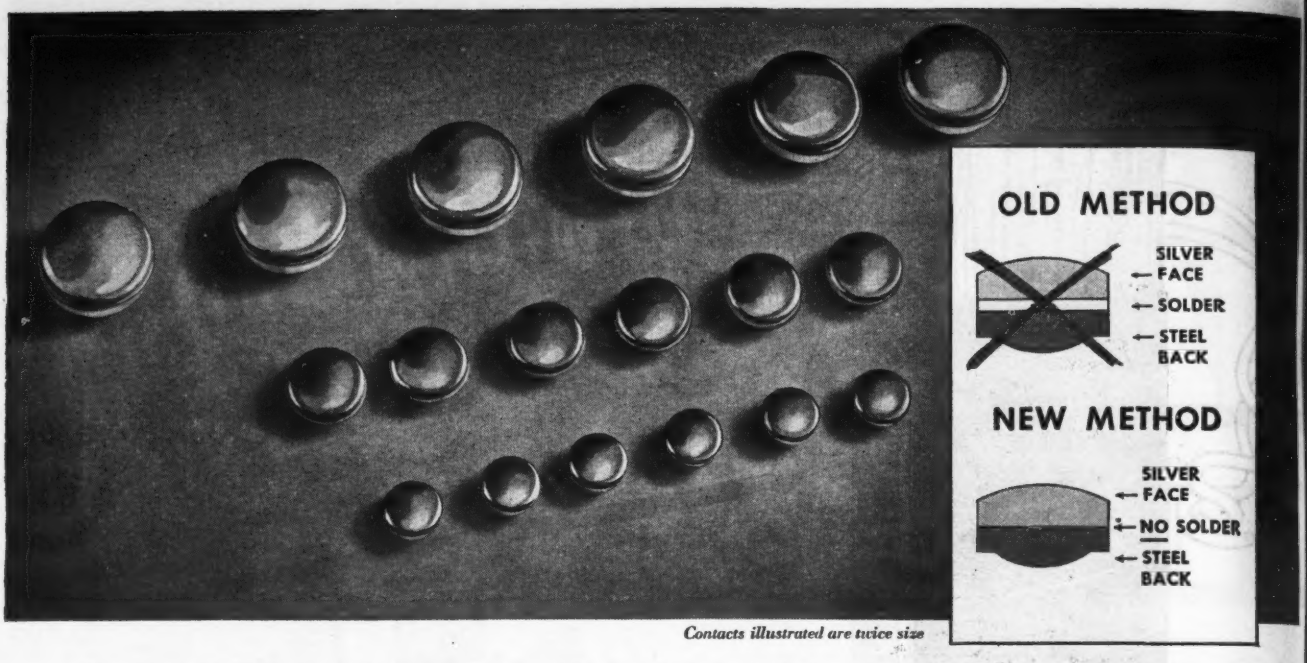
OSMOPLASTIC

Patented and Patents Pending

OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.

GENERAL OFFICES: BUFFALO 12, N. Y.

BRANCH AND SALES OFFICES: BIRMINGHAM 3, ALA.; DENVER 2, COLO.; NEW YORK 7, N. Y.; KENOVA, W. VA.; HARLAN, KY.; CHICAGO 4, ILL.



Contacts illustrated are twice size

Special Manufacturing Process Adds 20% Longer Life to MALLORY Silver-faced CONTACTS

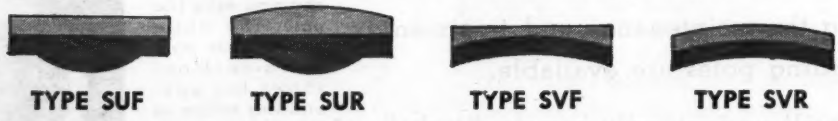
THE old method of making a silver-faced contact was to place a thin layer of solder and flux between the silver face and the steel back—then to heat the two pieces by furnace or torch, or to electrobraze them together.

This meant that the melted solder would penetrate the lower part of the silver face. As the silver wore down from constant use, it would finally reach the solder-saturated part. Wear would be immediately accelerated, and the life of the contact shortened.

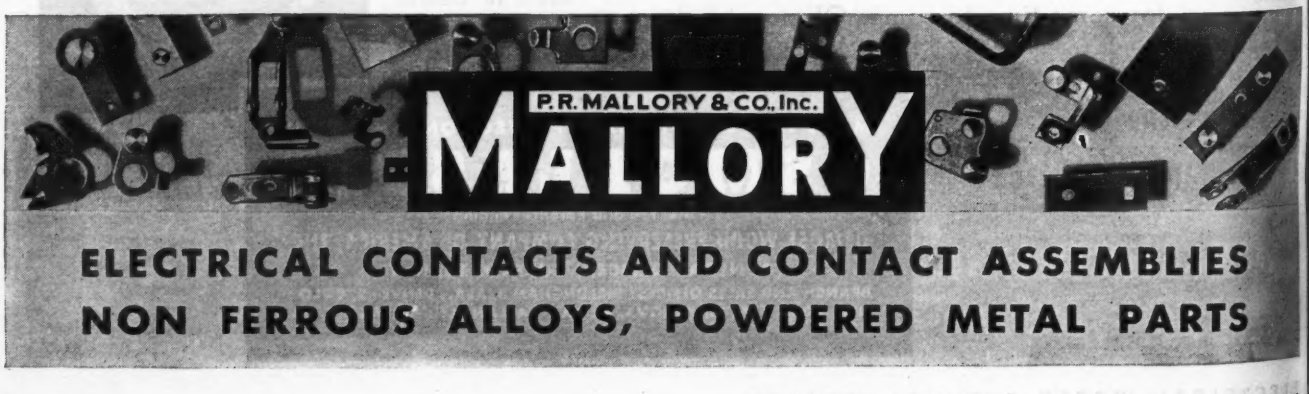
Mallory silver-faced contacts solve this problem — eliminate the use of life-shortening solder. The silver is directly bonded onto the steel or base metal backing, forming a perfect union. Since there is no alloy between the two, there is no danger of contamination.

Mallory standardized silver-faced steel-backed contacts are available for immediate delivery, and can be furnished attached to arms, studs, brackets, or ready for your own assembly operations. Detailed literature, with complete specifications and dimensions, is available upon request.

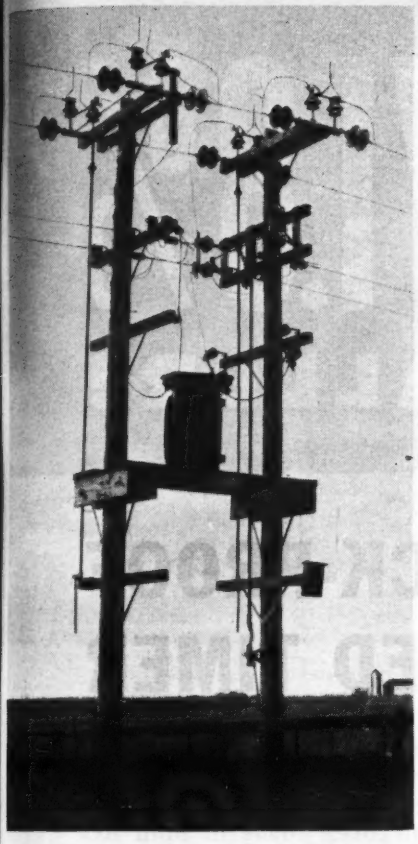
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA



A Reminder: Buy War Bonds

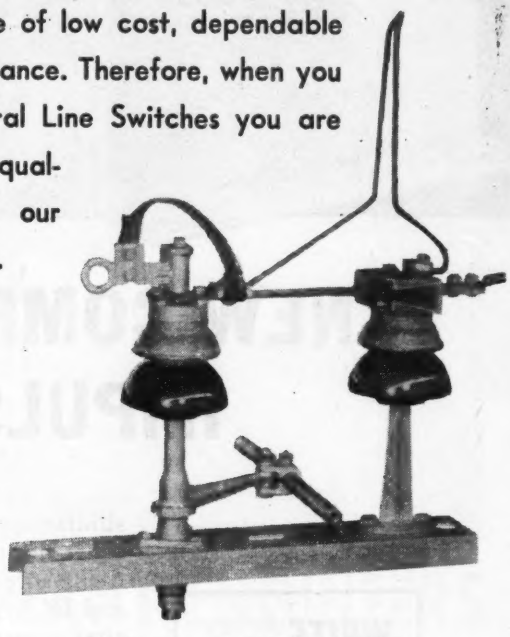


Each "THREE E" RURAL LINE SWITCH IS SPECIFICALLY DESIGNED FOR THE JOB



Two 6600-SU type and one 6600-SV type 15 k. v. Switches serving single phase rural substation.

The same experienced "THREE E" engineering and manufacturing ability that is back of our heavy duty line and station equipment designs and builds our rural line of switches. They are not "seconds" or heavier duty equipment cheapened to the 'nth degree. The reason for this is that we fully consider the importance of low cost, dependable rural line switch performance. Therefore, when you specify "THREE E" Rural Line Switches you are assured of the same top quality that characterizes our heavier duty equipment.



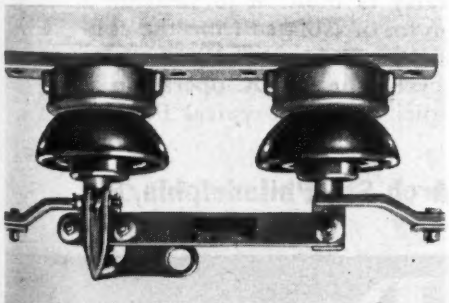
Single pole of 6600-SU Switch.

The 6600-SU type (horizontal mounted) and the SV type (vertical mounted) are two insulator single side break switches which are the most practical design for rural lines and substations. They incorporate the following outstanding features:

1. Occupy minimum mounting space on cross arms or structures
2. Arcing Horns
3. Sleet Hoods
4. Full floating contacts, wiping clean with each operation
5. Long, rigid bronze on babbitt bearings
6. Multi-pole group operation from remote point
7. All ferrous metal parts are hot dipped galvanized

These switches are made for voltages up to 15 k. v.

Send for Bulletin No. 330



S. P. S. T. 200 ampere 7.5 k. v. hook stick operated Disconnect, (closed).

S. P. S. T. 200 ampere 7.5 hook stick operated Disconnect, (open).

A complete line of hook operated disconnects are also manufactured for rural line service. They are the standard "THREE E" Double Blade construction and equipped with positive spreader type locking devices.

Send for Bulletin No. 324

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

A NEW COMPACT, SHOCK-PROOF IMPULSE-INITIATED TIMER

. . . . . 71.8% smaller than previous conventional units used for similar applications, Struthers-Dunn Type PSEH-1 impulse-initiated timer has the added advantages of rugged shock-proof construction, easily-accessible contacts, and dust-proof cover. Made in both AC and DC types, it operates the contacts at the end of a delay interval after power has been applied, or after receipt of a momentary impulse from a push-button, limit switch, or other source. The adjustable timing range is 20-to-1. The mechanism is immediately recycling. A double-pole, double-throw auxiliary relay is built in to provide a variety of circuit arrangements common to, or isolated from the control circuit. It can be supplied for AC operation on 110 V. 60 cycles or 25 cycles; 220 V. 60 cycles or 25 cycles; or for DC operation at any specified voltage from 6 to 120 volts. Size of a typical PSEH-1 Timer is 3½" x 3⅝" x 3¾".

WRITE *for copy of the Struthers-Dunn Catalog and Relay-Timer Data book.*

●

For details on the Timer illustrated above, please specify Type PSEH-1.

STRUTHERS-DUNN, Inc., 1321 Arch St., Philadelphia, Pa.

STRUTHERS-DUNN

5,288 RELAY TYPES

DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND
DALLAS • DENVER • DETROIT • HARTFORD • INDIANAPOLIS • LOS ANGELES • MINNEAPOLIS • MONTREAL
NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

Photo courtesy Electrical Contracting; Installation—Sperry Gyroscope Co., Nassau Plant, Lake Success, N. Y.

CORNING ENGINEERED LIGHTING *HELPS YOU SELL . . .*

BETTER ILLUMINATION TO PLANT ENGINEERS

Engineers agree that Corning *Flur-o-guides* are a practical means of securing the high levels of illumination needed for efficient lighting to meet today's increased production requirements. You can explain to them in their own language how these correctly designed *Flur-o-guides* provide adequate, uniform illumination over a wide area and eliminate glare and "dark" spots. Their decorative design fits well into today's architectural treatment.

Corning Lighting Engineers will be glad to work with you on any lighting problem you may have.

Corning Glass Works does not manufacture or sell lighting fixtures. Complete standard fixtures are obtainable from electrical fixture manufacturers.

CORNING FLUR-O-GUIDES PROVIDE ENGINEERED LIGHTING FOR SPERRY GYROSCOPE COMPANY

This view of the drafting room at Sperry Gyroscope Company's new Nassau plant shows how thorough, uniform illumination can be secured over wide areas through the use of Corning *Flur-o-guide* Lenses. Recessed troffer units, in continuous rows, equipped with *Flur-o-guide* Lens Panels, Code No. 90818, were used in this installation. Two 40 watt fluorescent lamps are mounted in each unit. Placed on five foot centers, this installation provides uniform lighting of approximately 80 ft. candles on the work area, with adequate shielding from light sources.

Send for a copy of "Corning Lighting Data." It contains specifications and applications on the complete line of engineered Corning *Flur-o-guide* Lenses and Panels. Address Lighting Sales Dept., EW10, Corning Glass Works, Corning, N. Y.

ORNING
means
arch in Glass

Corning Engineered Lightingware

REG. U.S. PAT. OFF.

Take a Load

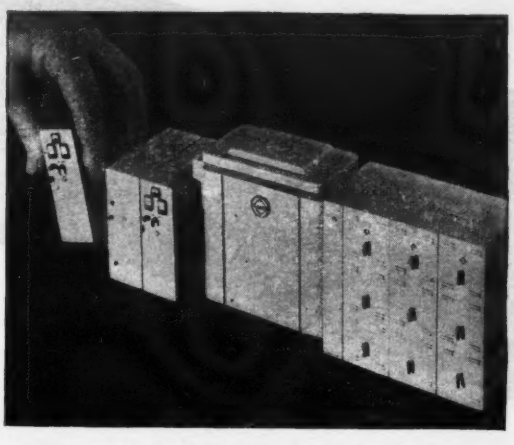
NEXT

ALLI

doff Your Mind

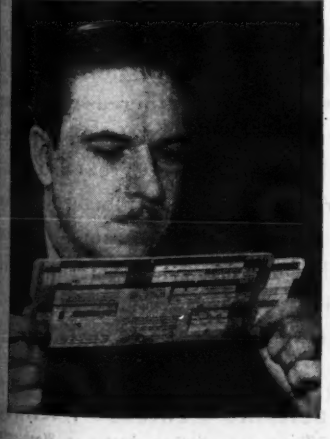
T TIME YOU PLAN UNIT SUBS!

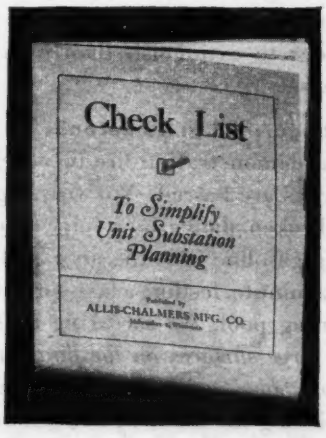
See how headaches disappear as you work out power distribution problems with Allis-Chalmers' new "Unit Sub Builder" Set! It's no toy, no stunt... but an *engineered* time- and trouble-saver!



1 YOU SEE WHAT'S AVAILABLE — without bogging down in charts, tables, catalogs. For a demonstration of the new unit sub models by an A-C field engineer, call your nearby Allis-Chalmers office. No obligation, of course.

2 YOU EXPERIMENT—Unit sub arrangements are assembled quickly. . . allowing easy comparison of alternate plans. You'll find models idea-stimulating.





3 NEW SLIDE RULE for figuring breaker interrupting capacities will save you time, trouble.

4 YOU VISUALIZE SOLUTIONS to your distribution problems *on the top of your desk*. You see what space the right unit sub will occupy, how it will actually look.

5 HANDY "CHECK LIST" provides a *double* check. Allis-Chalmers, Milwaukee, Wisconsin.

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

A 1748

E YOUR UNIT SUB IDEAS WORKED OUT WITH

CHALMERS *"Unit Sub Builder" Set*

Not Very Big . . . but PLENTY "MEAN"

You can't always judge the *toughness* of a fire by its size. Some relatively small fires fight back so viciously . . . hang on so stubbornly . . . that they are harder to extinguish than many big blazes.

Extinguished in 20 Seconds

Here's a demonstration fire in which no punches are barred. Not very big. Just a broken flange on a pipe line, spraying gasoline into the air . . . 10 gallons a minute, feeding a fast-spreading flaming pool. *No sheltering walls and no large surfaces on the flange to retain or make easier* the job of the extinguishing medium. Specifications for a fire that's *very* tough to handle.

First picture above shows fire after gasoline had been allowed to spray for a full minute. Yet, Cardox CO_2, discharged at the rate of 700 pounds per minute from a single Cardox nozzle (as shown in middle picture) extinguished this fire in 20 seconds.

Protecting *hard-to-handle* hazards is the job of Cardox Fire Extinguishing Systems engineered for the specific hazards and conditions at hand, and of Cardox Fire Trucks that put swift wheels under *tons* of carbon dioxide. Thanks to their distinctive ability to provide *mass* application of Cardox CO_2, Cardox Systems and Fire Trucks have taken over a roster of the toughest fire assignments in scores of war industries... and licked them to a standstill.

Enhanced CO_2 Performance

In Cardox Systems and Fire Trucks fast-acting, non-damaging carbon dioxide is given enhanced extinguishing performance because, as controlled and applied, Cardox CO_2: (1) Has uniform extinguishing characteristics regardless of plant or atmospheric temperatures; (2) Is available in ample quantity for application at high rate; (3) Provides high CO_2 "snow" yield for increased cooling effect; (4) Achieves effective projection through relatively great distances.

Write on company letterhead for Bulletin No. 5104, containing data on Cardox Engineered Systems and Mobile Equipment applicable to protecting oil industry fire hazards.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
District Offices in New York • Boston • Washington
Detroit • Cleveland • Atlanta • Pittsburgh
San Francisco • Los Angeles • Seattle

BUY WAR BONDS

READY
FOR WHAT MAY COME

It's in emergencies that Blaw-Knox construction is appreciated . . . High winds, sleet storms and violent changes in temperature impose unusual strains on exposed structures. To combat these destructive forces, Blaw-Knox towers possess a high weight-strength ratio plus a heavy protective coat of zinc which reduces maintenance costs close to zero.

BLAW-KNOX
TRANSMISSION
TOWERS

BLAW-KNOX DIVISION
of Blaw-Knox Company
2013 FARMERS BANK BLDG.
Pittsburgh, Pa.

New York Chicago Philadelphia
Birmingham Washington

"Premium" steel costing more per ton than ordinary merchant pipe.

Alloy composed of surface steel and zinc making a new metal, zinc-steel alloy.

Surface zinc over the alloy may be as thick as desired.

Sherasolution which impregnates zinc.

To Keep Away From Rust

** * To Keep Wiring Safe*

Sherarduct

✻ Threads as well as interior have equal protection with the outer wall of the conduit.

"Sherarduct" Conduit is made from high quality pipe. Under the Sherardizing process, the conduit is made rustproof, strong and durable. "Sherarduct" may be bent to conform to the necessary angles with a minimum of elbows. Once installed, "Sherarduct" becomes a well-joined, enclosed electrical raceway, fabricated into the job easily to withstand the test of time.

The same high quality materials used in the manufacture of "Sherarduct" are also used in the manufacture of other National Electric products. Write for the Engineering Data Book which lists our complete line of wiring materials.

It's YOURS for the writing

National Electric Products Corp.
Pittsburgh, Pa.

Electrical World

OCTOBER 28, 1944

Export Trade

HOW MUCH will American heavy industry want export business after the war? Will it want foreign trade enough to make it a major part of its promotional program, or will it want it just enough to fill in here and there the holes left vacant by domestic consumption?

It is not uncommon to hear that the British can give us cards and still run rings around us in the foreign field. Is that because the British are superior to us, or is it because we haven't half tried because we haven't felt the necessity for making export trade a major part of our business?

Our State Department is criticized for neglecting to build more career men, for its parsimonious attitude toward our foreign representatives, for not getting men who are looking out for American business, for doing little that is constructive to help American trade in foreign competition. Is that because the State Department doesn't care or is incompetent, or is part, if not most of it, because American business men blow hot and cold about exports? Is it because American business men have never felt the necessity for foreign trade strongly enough to demand from the State Department what they want?

Other nations have developed a large export business because that was the only way they could support a large manufacturing capacity. The home market was insufficient to consume all that their manufacturers could produce. Since their scale of living, their whole domestic economy depended upon the maintenance of industrial employment, it was essential that an export trade of major proportions be developed. Has America as the result of large-scale expansion of productive capacity reached the same position?

American business men know that the prosperity of this country is dependent upon maintaining, if not improving, the scale of living of our labor, which means high employment. They know that America can continue its leadership in world affairs only as it leads in industrial competency. They know that this demands constant improvement in efficiency. And everybody knows that no nation can long continue to improve industrial efficiency except its labor is well employed.

So it all comes back to this: Are domestic needs large enough to take substantially all of the production our industrial machine is capable of turning out? If they are not large enough then we must find some outlet outside our country for our production so that our people can be kept employed.

When we come to that decision, if we do, we shall find the American business man take an entirely different attitude toward foreign trade. We shall find American labor more conscious of our needs and, therefore, more demanding that the American product receive better attention at the hands of our foreign representatives, that our American consular people be better housed abroad and have more assistance. In short, when we are convinced of the necessity we shall find an entirely different feeling toward export trade and not treat it as we do now—as a filler-in.

It is something that every industry should study. We recommend it to the electrical manufacturers.

Voltage Compensation Charts Guide Generator Voltage Changes

Operating instruction in the form of graphic charts guide station operators in adjusting generator voltage to compensate for system voltage regulation—Charts coordinate load being generated with power factor at generator to indicate necessary sending voltage

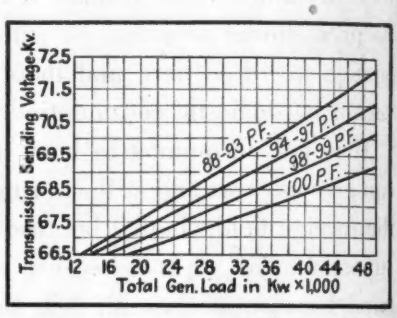
H. E. STITES, Electrical Engineer, Central Illinois Public Service Co., Springfield, Ill.

AS LONG AS system loads fluctuate widely, measures for compensating for system voltage regulation will be necessary so that suitable voltage levels may be maintained at load distribution centers. On the Central Illinois Public Service Co. system the nature of the territory and widely varying heavy loads imposed by coal mining operations have combined, in the past, to provide a system regulation problem that required considerable dispatching to combat.

This situation has been resolved, however, without recourse to installing expensive high voltage regulators with remote control. For more than a year effective compensation of system voltage regulation has been achieved by generator voltage control at power stations. Unique aspect of the particular scheme of generator voltage control employed is the use that is made, by station operators, of special graphical voltage control charts to guide generator voltage adjustment. These charts coordinate kilowatts being generated with power factor at the generator, to predetermine for the operator the transmission sending voltage that will provide proper load center voltage.

In designing these voltage control charts the usual basic calculations were carefully checked and compared with data obtained from station log sheets and from various voltage charts taken for the purpose.

The electrical system of the C.I.P.S. southern division where this scheme originated is basically as illustrated with 50,000 kw. generation at Grand Tower generating station divided into a block of 10,000-kw. load sent to the south and a 40,000-kw. block transmitted at 66 kv. to West Frankfort, which is a 33-kv. load distribution center. Radiating from this point are nine 33-kv. lines transmitting power to customer substations and various local low voltage distribution stations.

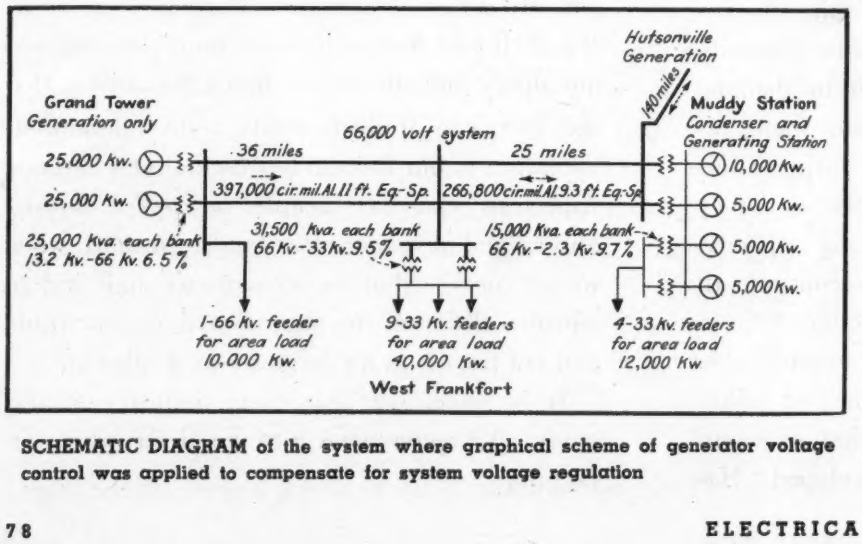


OPERATING CHART for Grand Tower station shows operator the transmission sending voltage required, for any generated load and power factor, to give suitable voltage at 33-kv. distribution load center on the system

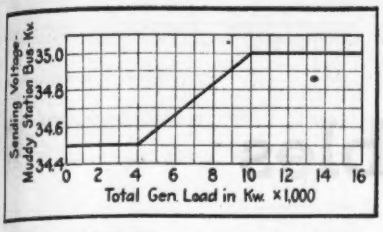
Values of sending voltage for the charts for this station were calculated so that the voltage drop for two 66-kv., 36-mile transmission lines and two 30,000-kva. transformer banks were compensated for. In addition, approximately two percent regulation was extended to the 33-kv. substation distribution bus. This regulation is carried out on the 33-kv. radial system feeding local distribution stations to compensate for voltage drop on that system.

Complications Encountered

This setup was complicated by a second power plant, known as Muddy Station, located 25 miles below the West Frankfort load area. This station is used as a combination generation and synchronous condenser station. Its total capacity is 32,000 kva. Muddy Station also serves as a 33-kv. distribution center and feeds area loads over four 33-kv. lines. Due to


Hutsonville Generation
140 miles
Grand Tower Generation only
Muddy Station Condenser and Generating Station
66,000 volt system
36 miles
25 miles
25,000 Kw.
25,000 Kw.
397,000 cir. mil. Al. 11 ft. Eq.-Sp.
266,800 cir. mil. Al. 9.3 ft. Eq.-Sp.
10,000 Kw.
5,000 Kw.
5,000 Kw.
5,000 Kw.
25,000 Kva. each bank 13.2 Kv.-66 Kv. 6.5 %
31,500 Kva. each bank 66 Kv.-33 Kv. 9.5 %
15,000 Kva. each bank 66 Kv.-2.3 Kv. 9.7 %
1-66 Kv. feeder for area load 10,000 Kw.
9-33 Kv. feeders for area load 40,000 Kw.
4-33 Kv. feeders for area load 12,000 Kw
West Frankfort

SCHEMATIC DIAGRAM of the system where graphical scheme of generator voltage control was applied to compensate for system voltage regulation



HOW VOLTAGE at composite generator condenser station is raised after load reaches 4 mw.

this condition it was advisable to operate this station on a single voltage curve ignoring power factor but holding, by use of synchronous equipment, a suitable sending voltage on the 33-kv. system. It will be noted from the graphic chart for this station that a 500-volt compensation is applied to the 33-kv. bus. This chart has proven to be satisfactory and has simplified the application for the station operation.

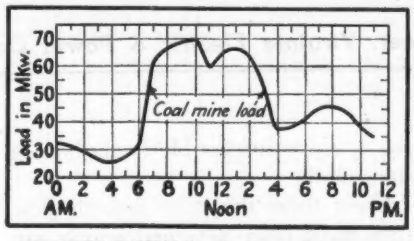
From Muddy Station there is an interconnection to the north with the northern portion of the company's system. This interconnection is made through a 66-kv. transmission line of considerable length which also serves a load area of nearly 10,000 kw. that normally fed from the northern division. In making our calculations and tests it was felt that this interconnection could be ignored as far as this particular problem is concerned. This assumption later proved to be correct.

Charts Simplified Procedure

Accompanying voltmeter charts taken on the West Frankfort 33-kv. bus show the results of operating under this graphically-guided system of voltage control. The "before" chart was taken at a time when the receiving voltage was controlled by the local West Frankfort operator, calling the power plants for changes in voltage as he thought advisable. This shows a consistent voltage but to maintain it required a considerable amount of time by the operators in both the stations.

The "after" chart was taken from the same voltmeter after resorting to compensating at the power station, as discussed above. It will be seen that this chart is a little smoother and is compensated during the load period for about 2½ volts or 3 volts on a 120-volt base at the receiving station. This compensation was carried out on the 33-kv. system to correct for drop in that system, as was previously explained.

A typical daily load curve for this system area reveals a minimum load of 25,000 kw. and a maximum load of 70,000 kw. This wide load range arises from the fact that load in this area consists mainly of coal mines. The rapid change in load and extreme conditions require careful control of the voltage and it is felt that in comparing the load curve with the voltage charts that this system of control has proven satisfactory and will be continued.



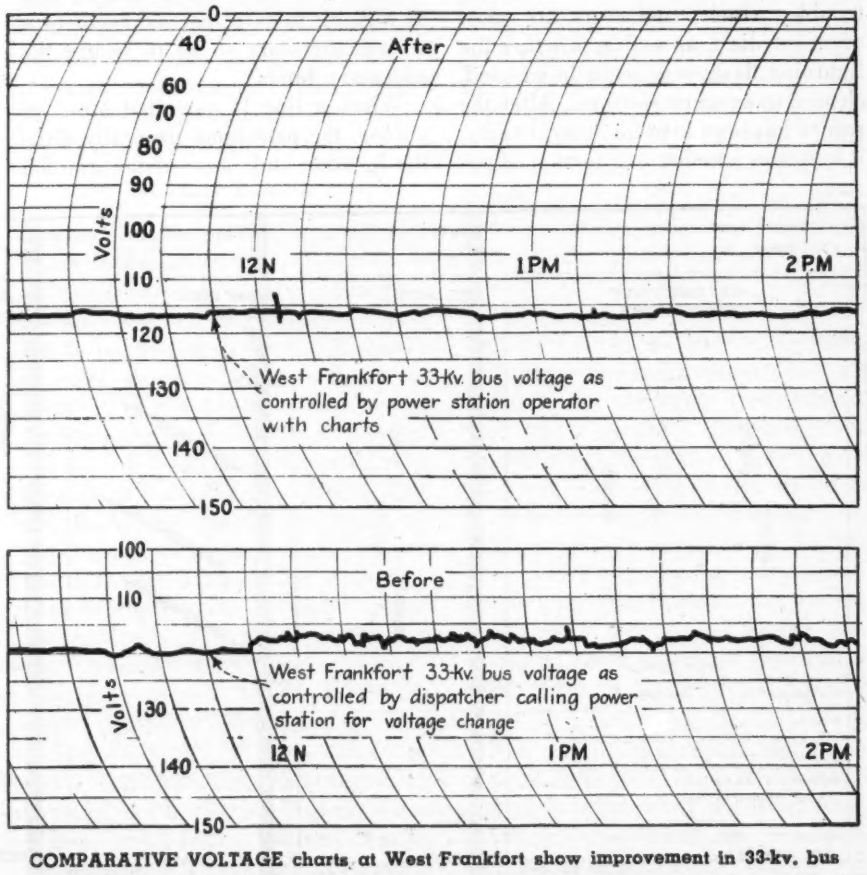
TYPICAL DAILY load curve shows system load extremes caused by coal mining operations in the area

This same system of voltage control has been applied to other generating stations and power sources feeding the Central Illinois Public Service Co. system. In one case a hydro-plant belonging to one of our neighboring companies was placed under operation using this system. The voltage was compensated to take care of very high impedance sending and receiving transformers and widely spaced conductors on the 66-kv. line. The change has proven very satisfactory in practice and will continue in use.

Second Application Satisfactory

In another case where power was being received over three high-voltage transmission lines all of which fed the same 33-kv. network systems. This same system is employed to keep the regulators balanced on the three lines feeding this system so that each line carries its share of the kilowatts and kilovars. This application too has proven to be satisfactory.

Thus operating instructions in the form of graphic compensation charts guide the station operating force in adjusting the generator voltage to compensate for the system voltage regulation. The charts, as has been explained and illustrated, coordinate the load being generated with the power factor at the generator assist in determining the voltage at the station bus.



COMPARATIVE VOLTAGE charts at West Frankfort show improvement in 33-kv. bus voltage, as controlled by power station operator with charts, over previous condition when dispatcher called power station for voltage change as needed

Keeps Chart Record of Transmission Line Troubles

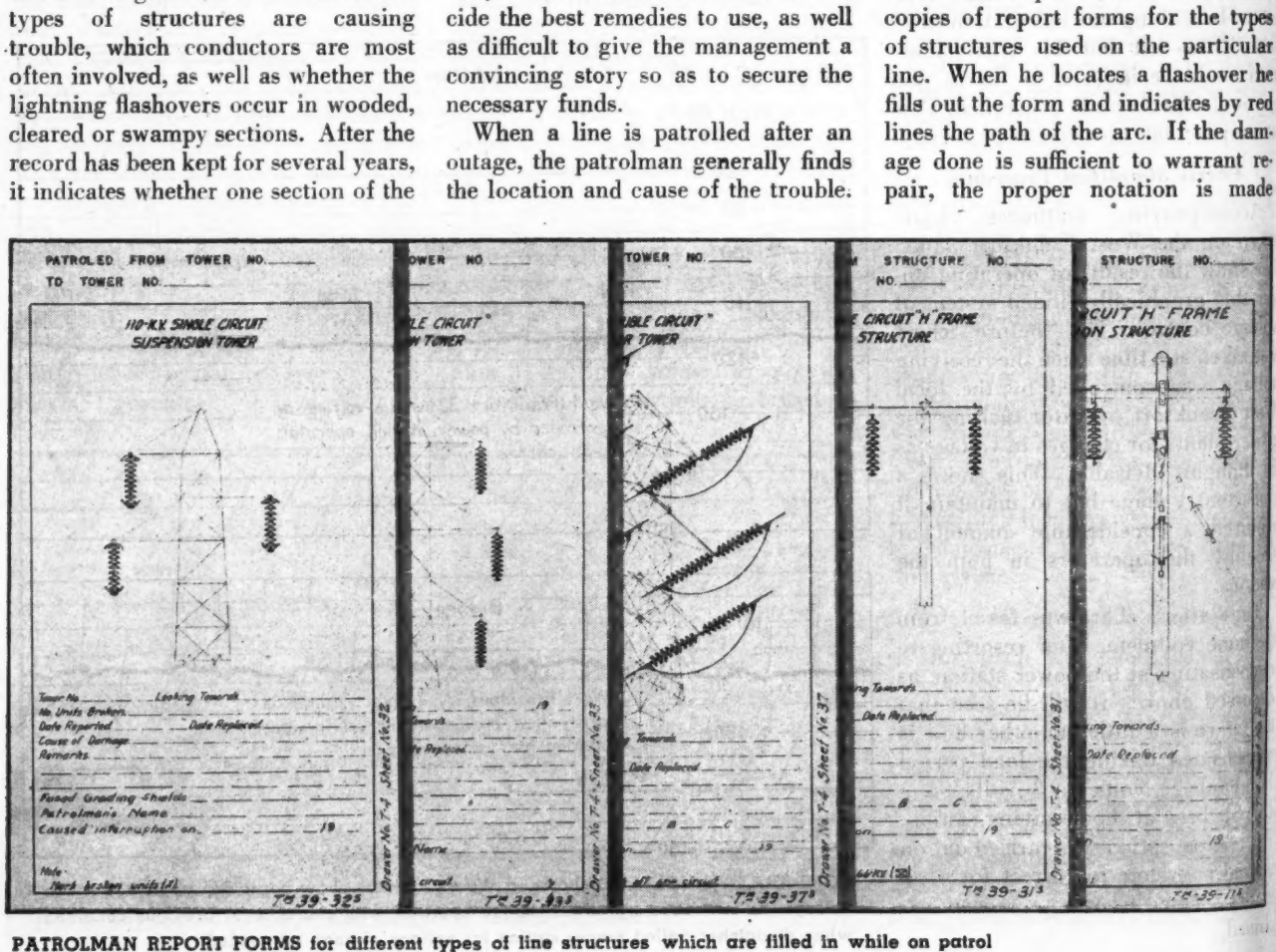
Graphic presentation of line operating data gives quick, comprehensive picture of performance and is useful to indicate possible improvements as well as for new line design

J. A. RAWLS, Construction Engineer, Virginia Electric & Power Co., Richmond, Va.

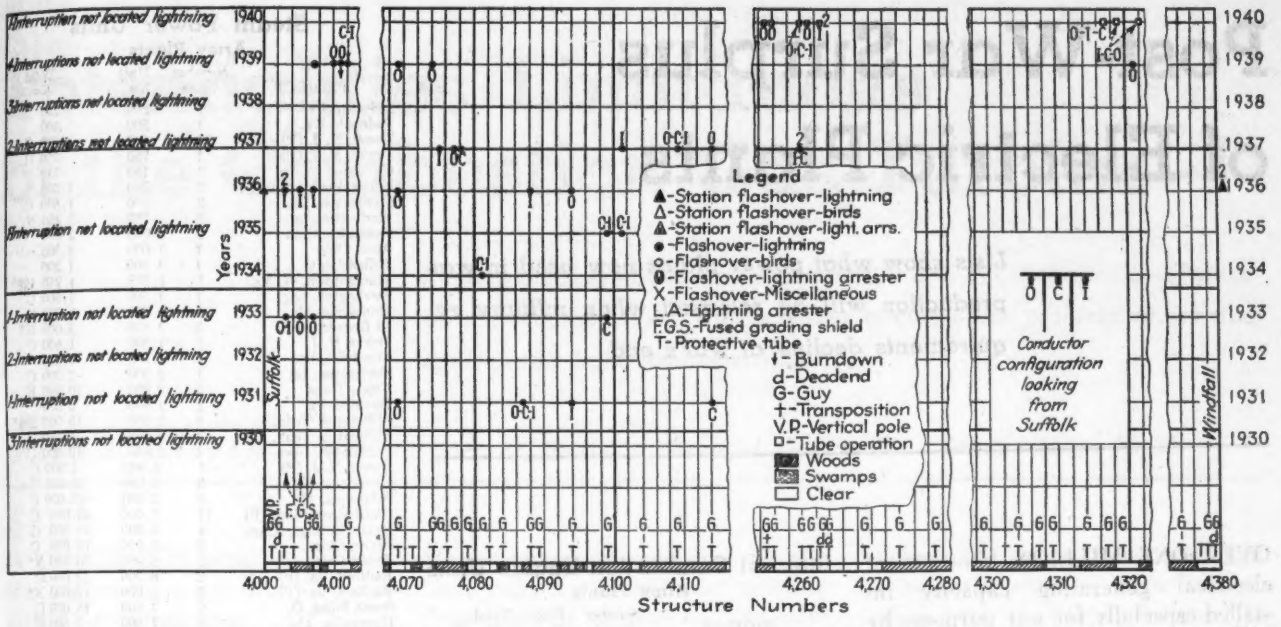
FLASHOVER RECORD CHARTS have been kept since 1930 for all 110,000-volt lines on the system of the Virginia Electric & Power Co. The original records covered the period 1930 through 1940. Similar charts of succeeding years can be placed directly above the originals to carry the record on. These flashover records have been very valuable in connection with the design of new lines, as well as making improvements to existing lines. At a glance, one can tell which types of structures are causing trouble, which conductors are most often involved, as well as whether the lightning flashovers occur in wooded, cleared or swampy sections. After the record has been kept for several years, it indicates whether one section of the line is more susceptible to flashovers than another.

From these flashover records new lines have been designed which are practically free from lightning; wood crossarms have been used to replace steel crossarms on steel towers with gratifying results; protective gaps have been added to sections of wood lines and other worthwhile improvements have been made. Had it not been for the flashover records on each line, it would have been hard to decide the best remedies to use, as well as difficult to give the management a convincing story so as to secure the necessary funds.

When a line is patrolled after an outage, the patrolman generally finds the location and cause of the trouble. In order that all patrolmen will supply uniform information, patrolman report forms are supplied. The forms consist of sketches of types of 110,000-volt structure used on the system with the exception of very special ones. Each sketch is on a separate sheet and below it are blanks to be filled in showing the date, tower number, damage done, cause of damage, date of interruption caused by the flashover, etc. When the patrolman leaves on a patrol, he takes blank copies of report forms for the types of structures used on the particular line. When he locates a flashover he fills out the form and indicates by red lines the path of the arc. If the damage done is sufficient to warrant repair, the proper notation is made



PATROLMAN REPORT FORMS for different types of line structures which are filled in while on patrol



GRAPHIC TRANSMISSION LINE RECORD shows design details, character of terrain and information on outages

under "Remarks". The forms are all turned in to one person who is in charge of following them up.

The patrolman's report forms were first originated to give the man in charge of transmission line operation a uniform picture of troubles that were being encountered on the lines. Later when new transmission lines were designed, the forms were used to advantage by design engineers since they gave a history of the troubles that were being experienced on existing lines.

In order to make the information received from the field on patrolling lines as useful as possible, we decided to make up a flashover record chart for each section of 110,000-volt line. By a section of line is meant any portion that automatically clears from the remainder of the system and becomes de-energized due to trouble on the particular section. The chart is made up on graph paper which can be blueprinted; it is divided vertically so that there is space for each structure number, and horizontally so that there is space for each year involved. Across the bottom of the chart the structure numbers appear and directly above these is shown by symbols whether the line passes through woods, swamps or cleared land. Above these are other symbols which tell whether the structure is guyed, dead-end, transposition, vertical pole, or has any special protection, such as protective gaps, fused grading shields or lightning arresters. A sketch of the type of structure used on the line is shown on the chart on which the conductors are identified as "O" for outside, "C" for center and "I" for inside on horizontal configuration and "T" for top, "C" for center and "B" for bottom on vertical configuration. Underneath the sketch the direction is noted. There also appears on the sheet a legend which gives a symbol for each type of flashover normally encountered. This legend also explains the symbols for the different types of structures, etc.

Symbols Entered

After the chart is made up with the above information, the patrolman report forms are taken for the particular line for each year and the proper symbol is entered to cover the flashover at every structure where a flashover occurred. The conductors involved in the flashover are noted below the symbol as O-C-I or T-C-B depending on the type of construction. If more than one flashover occurred on the same structure during the same year, a figure is placed above the symbol to indicate the number of flashovers on the structure. There are generally a few interruptions each year, the cause for which cannot be located in the field. If these interruptions occurred during an electrical storm, the number is indicated at the beginning of the chart by years. If records of electrical storms over a section of line are kept, the number per year could be noted at the beginning of the sheet also.

The flashover record sheet for a thirty-five mile length of 110,000-volt wood "H" frame line which had been in service since 1926 and was subject to many outages due to lightning flashovers that something had to be done, indicated that 81 percent of the flashovers due to lightning for a ten-year period were on guyed structures. Since this was the case, protective gaps were installed principally on the guyed structures at a cost which was approximately one-fourth the cost to install them on all structures. Four years operating experience with the installation indicated that the tubes have reduced the flashovers due to lightning by approximately 95 percent. By following the flashover record charts other improvements have been made on 110,000 volt lines.

Other useful information could be added to the flashover record chart such as a profile (elevation) of ground along the center of the line to the same scale used for the structure numbers. It might also be useful to indicate the type of soil along the line if the information is available, as well as enter a curve showing the footing resistance of each tower in the case of a steel tower line or in the case of wood lines with overhead ground wires.

The patrolman's report and flashover records have been found to be extremely valuable. The cost of keeping them is negligible in comparison with the savings made from their use in designing new lines and making improvements to old ones.

Post-War Surplus of Electric Plants

Lists show what power plants now used in war production will be released when military requirements decline at war's end

OVER ONE MILLION kilowatts of electrical generating capacity installed especially for war purposes by the Army, Navy and Defense Plant Corporation will become surplus when the war ends. This does not include capacity in the Tennessee Valley Authority, Bonneville and other government power systems that will be underloaded when peace comes. The capacity tabulated here is only that which is expected to be available as complete plants or in equipment items for sale to any buyer or for transfer to government agencies other than present owners.

Internal combustion engine units, 189 of them, ranging in size from 50 to 2,250 kw., account for 141,193 kw. of the total 1,111,243 kw. of expected surplus. Reciprocating steam engines in 11 units add up to 12,150 kw., and the remainder of 957,900 kw. is in steam turbines in sizes from 100 to 50,000 kw. Included among the larger sizes are four 35,000-kw. units, one 40,000, one 45,000 and one 50,000; medium-sized units of 5,000 to 7,500 kw. predominate in the lists.

These lists do not include additions to existing plants made in various Navy Yards and which are regarded as permanent. There may be further additions to Navy Yard plants and capacity for them will probably be taken from these lists as is to be expected under the terms of the surplus property disposal bill.

A few of the steam plants listed are operated on waste heat from industrial processes and will require boiler equipment to make them complete electricity production units. Information obtained does not include identification of these plants.

Internal Combustion Engine Units

Army Plants

PROJECT	Number Units	Unit Kw.	Total Kw.	Type
Boise, Idaho	3	50	150	D
Foster Field, Texas	1	50	50	G
Atlanta, Ga	4	75	300	D
Foster Field, Texas	1	95	95	G
Victoria, Texas	4	125	500	G
Flagstaff, Ariz.	1	125	125	D
Wendover Field, Utah	3	140	420	D
Windsor Locks, Conn.	1	150	150	Ge
Minneapolis, Minn.	1	200	200	D
Fort Leonard Wood, Mo.	1	200	200	D
Fort Leonard Wood, Mo.	1	200	200	Ge
Huntsville, Ala.	1	225	225	G
Columbus, Ohio	1	250	250	D
Foster Field, Texas	1	250	250	G
Huntsville, Ala.	1	275	275	G
Pueblo, Colo.	1	300	300	D
Independence, Mo.	2	400	800	D
Sidney, Neb.	3	450	1,350	D
Fort Huachua, Ariz.	1	531	531	G
Sidney, Neb.	1	535	535	D
Proving Grounds, Ill.	3	600	1,800	D
Proving Grounds, Ill.	1	750	750	D
Pine Bluff, Ark.	3	750	2 250	G
Fort Huachua, Ariz.	3	875	2,625	G
North American Aviation, Inc., Kansas City, Kans.	3	1,000	3 000	D
Eldorado, Ark.	11	1,000	11,000	G

Navy Plants

PROJECT	Number Units	Unit Kw.	Total Kw.	Type
Iona Island, N. Y.	1	125	125	D
Miami	2	187	374	D
Bainbridge Island, Wash.	1	250	250	D
Elizabeth City, N. C.	1	260	260	D
South Weymouth, Mass.	1	375	375	G
Banana River, Fla.	2	375	750	Ge
Olathe, Kans.	1	375	375	D
Metal & Orchard Points, Wash.	1	450	450	D
Quillayute, Wash.	1	625	625	D
Metal & Orchard Points, Wash.	1	938	938	D
Banana River, Fla.	1	1,000	1,000	D

Defense Plant Corporation Plants

PROJECT	Number Units	Unit Kw.	Total Kw.	Type
Painesville, O.	2	100	200	Ge
Clewiston, Fla.	2	120	240	D
Litchfield Park, Ariz.	1	125	125	D
Chickasha, Okla.	1	125	125	Ge
St. Louis	1	200	200	G
Columbus	1	200	200	Ge
Farmingdale, L. I.	2	200	400	D
Metaline Falls, Wash.	1	200	200	D
Cotton Valley, La.	5	250	1,250	G
Bishop, Texas	2	250	500	G
Driscoll, Texas	1	250	250	G
Eldorado, Ill.	2	250	500	D
	1	275	275	D
Northgate, Colo.	1	300	300	D
Metaline Falls, Wash.	1	375	375	D
Jumasha, Peru	2	600	1,200	D
Jones Mills, Ark.	50dc	750	37,500	G
Sweeney, Texas	2	750	1,500	G
Jumasha, Peru	2	800	1,600	D
Grand Prairie, Texas	3	1,000	3,000	D
Borger, Texas	18	1,000	18,000	G
Jones Mills, Ark.	18dc	2,250	40,500	G

D — Diesel engine.
G — Gas engine.
Ge — Gasoline engine.
dc — Direct current generator.

Steam Power Units

Army Plants

PROJECT	Number Units	Unit Kw.	Total Kw.
Indianapolis	1	200	200
Paducah, Ky.	1	500	500
Dover, N. J. (P)	1	600	600 C
Dover, N. J. (P)	1	750	750 C
Chicago	1	750	750
Milwaukee	2	750	1,500
Sterlington, La.	2	750	1,500 C
Sterlington, La.	3	750	2,250 N
Sandusky, Ohio	2	1,000	2,000
Apco, Ohio	1	1,000	1,000
Philadelphia	1	1,200	1,200
Morgantown, W. Va.	1	1,250	1,250 10#*
Sterlington, La.	1	1,500	1,500 C
Huntsville, Ala.	1	1,500	1,500 C
El Dorado, Ark.	2	1,500	3,000 N*
Dover, N. J.	1	1,500	1,500 C
Meadville, Pa.	1	1,500	1,500
Sterlington, La.	1	2 000	2 000 C
Etter, Texas	5	2,000	10 000 R
Danville, Pa.	1	2,500	2,500
Millington, Tenn.	4	2,500	10 000 20#*
Millington, Tenn.	2	2,500	5,000 C
Burlington, Iowa	4	2,500	10,000 C
Dover, N. J. (P)	1	3,000	3,000 C
Henderson, Ky.	3	3,500	10,500 C
Sylacauga, Ala.	8	5,000	40 000 C
Charlestown, Ind. (P)	11	5,000	55,000 C
Baxter Springs, Kans.	4	5,000	20 000 C
Pryor, Okla.	2	5,000	10 000 C
Pryor, Okla.	2	5,000	10 000 N*
Radford, Va. (P)	2	6,000	12 000 C
Radford, Va. (P)	2	6,000	12,000 N*
South Point, O.	2	7,500	15,000 C
Huntsville, Ala.	1	7,500	7,500 C
Louisiana, Mo.	3	7,500	22,500 C
Morgantown, W. Va.	2	7,500	15,000 C
Denver, Colo.	1	7,500	7,500 C

Defense Plant Corporation Plants

PROJECT	Number Units	Unit Kw.	Total Kw.
Texas City, Texas	1	100	100 N
Norwalk, Calif.	1	100	100 N
Chester, Pa. (STB)	1¹	150	150 CR
Indianapolis	1	200	200 N
Chester, Pa.	1¹	200	200 CR
Baltimore	1¹	200	200 NR
Baltimore	1¹	300	300 NR
Winona, Minn.	1	300	300 NR
Monticello, Utah (STB)	2	375	750 C
Carlsbad, N. Mex. (STB)	1	500	500 50#*
Pekin, Ill.	2	500	1,000 15#*
Norwalk, Calif.	1	800	800 C
	2	800	1,600 C
Boulder City, Nev.	1	1,000	1,000 30#*
St. Louis	1¹	1,000	1,000 CR
Memphis, Tenn.	2	1,000	2,000
Trenton, N. J.	1¹	1,250	1,250 C
Texas City, Texas	2	1,250	2,500 N
Belvidere, N. J.	2	1,250	2,500 35#*
Memphis, Tenn.	1	1,500	1,500
New Martinsville, W. Va.	1	1,500	1,500 30#
Oriente Prov., Cuba	4	1,500	6,000 C
Oriente Prov., Cuba	2	1,500	3,000 2#
New Castle, Pa.	2¹	1,500	3,000 C
Houston, Texas	1	1,600	1,600 5#*
Willow Run, Mich.	2	2,500	5,000 C
Bavtown, Texas	1	3,000	3,000 C*
Oriente Prov., Cuba	1	3,000	3,000 7#
Houston	1	3,500	3,500 C
Akron, Ohio	1	4,000	4,000 10#*
Bavtown, Texas	1	4,000	4,000 C
Gadsden, R. I.	1	5,000	5,000 .
Bavtown, Texas	1	5,000	5,000 C
Baton Rouge P. STB	2	6,000	12,000 10#*
Bauxite, Ark. (P)	1	6,000	6,000 11#*
Ludington, Mich. (P)	2	6,000	12,000 C
Youngstown, Ohio	1	7,500	7,500 21#*
Lake Charles, La. STB	6	7,500	45,000 C
Lake Charles, La.	1	7,500	7,500 C
Lake Charles, La.	1	7,500	7,500 C
East Chicago	3**	7,500	22,500 C
New Martinsville, W.Va.	1	7,500	7,500 C
New Martinsville, W.Va.	2	7,500	15,000 17#*
Daingerfield, Texas	1	7,500	7,500 C
New Martinsville, W.Va.	1	10,000	10,000 C
Daingerfield, Texas	1	10,000	10,000 C
Morenci, Ariz.	1	12,500	12,500 C
Lake Charles, La. STB	1	15,000	15,000 C
Freeport, Tex. M	1	20,000	20,000 C
Braddock, Pa.	2	25,000	50,000 C
	2²	30,000	60,000 C
Velasco, Texas	1	35,000	35,000 23#*
Lake Charles, La. STB	1	35,000	35,000 C
Kohuta, Pa.	1	35,000	35,000 16#*
Houston (P)	1	35,000	35,000 16#*
Velasco, Texas	1	40,000	40,000 C
Velasco, Texas	1	45,000	45,000 C
Provo, Utah	1	50 000	50,000 C

P — Integral part of manufacturer's plant.
M — In manufacturer's station.
STB — Standby
C — Condensing
N — Non-condensing
R — Reciprocating engines
¹ — Direct-current units
² — Floating power plants
* — These units are of a high back-pressure type and cannot be operated unless there is a local use for the steam discharged.
** — 25 Cycle

Potentialities, Limitations of the Combustion Gas Turbine—I

Factors limiting efficiency, compactness and cycle simplicity—Potentiality for combination with existing cycles—The problem of starting, control and light load operation

GLENN B. WARREN, Turbine Engineering Division, General Electric Co., Schenectady, N. Y.

IN CONNECTION with all gas turbine designs there are four very important considerations:

(1) The compressor and turbine efficiencies must be high.

(2) The initial temperature ahead of the turbine must be high.

(3) The parasitic pressure drops must be low.

(4) The ambient temperature entering the compressor must be low.

When one considers Fig. 1 and realizes that the net power is the difference between the turbine output and the compressor input, the reason for the above four principles becomes immediately apparent. Generally, the compressor requires from ½ to ⅘ of the total power developed from the turbine, depending upon the values of the above quantities. In the early machines the compressor actually took more than the turbine power to operate it. From the standpoint of the efficiency of the cycle, the compressor work is not lost, and with high enough compressor and turbine efficiencies, is nearly all regained in the turbine.

Air Volume and Temperature

The importance of, the difficulty of, and the cost of procuring low parasitic pressure drops is not so generally appreciated. The volumes of gas flow are tremendous, in the general order of 9,000 to 12,000 cu. ft. per minute per 1,000 hp. of net output of the set. The total available pressure drop is not great compared to a steam turbine for instance. As a result, the obtaining of sufficiently low entrance and exit losses to and from the machines, of low pipe drops, and of low combustion chamber pressure drops is most important; and on more efficient regenerator units the pressure drops must be reduced on both sides through the heat exchanger surface to the minimum possible value, otherwise excessive power losses will result.

The great effect of the ambient or incoming air temperature is not generally appreciated. The work of the compressor is directly proportional to the absolute temperature of the entering air; and if the power absorbed by it at 80 deg. F. or 540 deg. F. abs. is twice the net power, then at 0 deg. F. the compressor will absorb but 82 percent as much, and the net power will be increased in the ratio of 50 percent to 68 percent or 36 percent. On the other hand, the air will come out of the compressor about 120 deg. F. colder depending upon the pressure ratio, and in the absence of a regenerator will have to be heated up this much further by the fuel. This will, however, only take at most 10 percent more fuel; so we have a machine that produces 36 percent more power on 10 percent more fuel when running at the colder temperature, i.e., its efficiency will be about 25 percent greater. Similarly, a still greater gain would result if even colder air could be taken in; and, conversely, a loss of sizeable magnitude would take place if the plant were to have to run in the desert.

The power of a gas turbine is also directly affected by the barometric pressure of the inlet and exhaust if the ambient temperatures are constant. Both gross and net output are directly proportional to the barometric pressure, but the efficiency is not thereby affected. Thus, at a high altitude where the barometer reads half of sea level pressure, a gas turbine would have to be proportioned to handle double the volume of air.

Simple and Modified Cycles

Basically, two variations in the gas turbine cycle are being considered today. The first is the simple cycle shown in Fig. 1. This has no heat exchanger surface whatever, and is probably one of the simplest prime movers known. It should be capable of obtaining overall thermal efficiencies in the neighborhood of 16 percent to 18 percent. Possibly, with higher initial or lower ambient temperatures, 20 percent can be obtained.

Fig. 2 shows the two principal modifications being considered. These are a heat exchanger or regenerator in the exhaust and an intercooler in the compressor. If a heat exchanger that would give complete recovery of the exhaust heat down to the temperature of the air leaving the compressor were to be used, the gain in economy would be about 30 percent to 40 percent, but such a heat exchanger would be impossible. To get 50 percent or 75 percent of this recovery is feasible; and would require about ¾ sq. ft. per hp. or 2½ sq. ft. per hp., respectively; and would give about ½ or ¾ of the above gain in economy, respectively, reduced somewhat by pressure drops. This is to be compared to the modern steam plant which has a total of about 2 sq. ft. per hp. in boiler, superheater, economizer, air preheater, and condenser. In some gas turbine designs, however, from 10 to 12 sq. ft. per hp. are actually being considered in the heat exchangers. This seems excessive.

An intercooler in the compressor

will give a gain in output depending upon the cooling temperature available, and will give a gain in efficiency if used in connection with an exhaust heat regenerator. This gain in net output is roughly 15 percent, and the gain in economy due to the intercooler is about 10 percent if a regenerator is used. Thus, the cycle shown in Fig. 2 should, with turbine and compressor efficiencies and initial temperatures that seem obtainable, and somewhat greater than a 50 percent heat exchanger, have an overall efficiency of 25 percent to 27 percent, or a fuel consumption of about 0.53 lb. of oil per hp. hour. This will probably be a good commercial machine for many purposes.

Combined Steam and Gas Turbine

Normally the temperature leaving the combustion chamber is kept low enough for the turbine by adding excess air. This requires compressor power. This could also be done by injecting water.

If the consumption of water is not a disadvantage, if the pressure ratio is in the higher ranges, and if the set is designed for it, water can be injected ahead of the heat exchanger with a very considerable increase in net power and without too great a detrimental effect on the efficiency. It is theoretically possible to inject the water into the entrance of the compressor, and so secure still greater advantages, since some cooling of the air during compression results, including a gain in overall efficiency, but the practical difficulties are great. For instance, there will be difficulties in maintaining proper mixing, in mechanical losses and erosion of compressor blades, or else deposits on the blades with resulting decreases in compressor efficiency and increased maintenance. The same may be true on the heat exchanger surface.

All of these practical difficulties can be eliminated if this scheme is carried to the ultimate and the gas turbine combined with a steam boiler and condensing steam plant, and then the Brown Boveri "Velox boiler" scheme results. It is quite possible, however, that for many applications the gas turbine may be advantageously combined in some manner with a steam cycle.

Generally, the control of a gas turbine will be simple, since the net output can be varied simply by varying the amount of fuel fed into the combustion chamber.

If a turbine as in Fig. 2 is run at a constant speed and lighter loads, the economy is rather poor, the no-load fuel consumption being as much as 30 percent to 40 percent of that at full load. On the other hand, for each fractional load there is a best lower speed, and if the set is run at this speed the fuel consumption will be about one-half as much. The simpler gas turbine without the regenerator suffers somewhat worse in this respect. These are modifications in design, however, which can be made to improve this light load fuel consumption, but generally some other factors may have to be sacrificed.

This variable speed presents certain difficulties, particularly for a.c. generator drive. This can be overcome to some extent by dividing the gas turbine part of the set. Either a series or parallel arrangement may be used. Thus a high pressure element may exhaust into a low pressure element or two separate turbines operating between the same initial and exhaust pressures may divide the gas flow between them. With either arrangement, one turbine drives the compressor and the other delivers the net output of the set. The compressor set can then run at the best speed for economy at each load and the power turbine can run at fixed speed or any speed suited to the load. This has many other advantages and also several disadvantages.

The gas turbine must be started by

FIG. 1

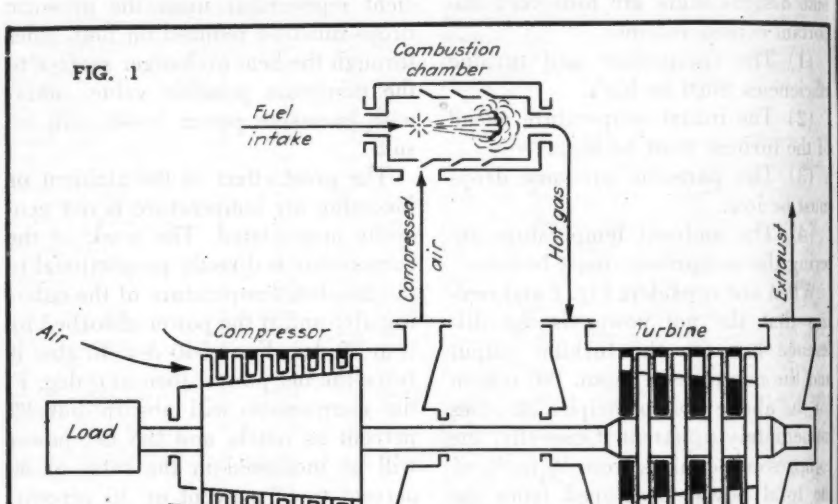
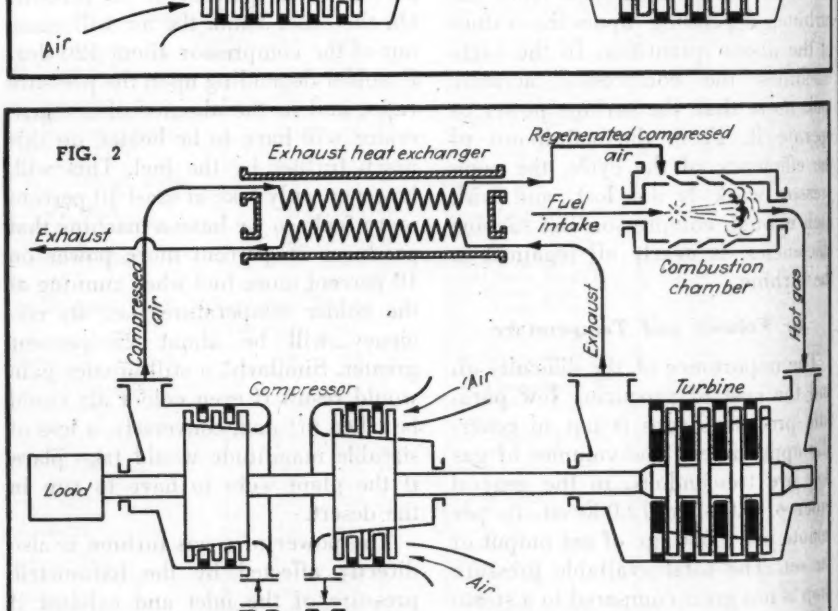


FIG. 2



SIMPLE GAS TURBINE CYCLE (Fig. 1) is one of the simplest prime movers known. Gas turbine cycle (Fig. 2) with intercooling and regeneration

external power. This is simpler if the compression ratio is not too high, and if the compressor does not have an intercooler. The starting power will probably be from 1 percent to 3 percent of the net power output depending upon conditions. Under certain conditions it may even be less.

Compressor and Turbine Arrangements

Multi-stage centrifugal compressors could be used, and would probably be satisfactory if intercooled, but would be bulky and lower in efficiency, based on any known designs, then would be true with properly designed axial flow machines. Some designers are considering the new Lysholm type constant displacement blowers. These machines are reputed to have a good efficiency when used as a two or three stage compressor, but are much heavier and more bulky than the axial flow type. They might not be so susceptible to loss in efficiency and pressure rise with dirt, however.

As mentioned earlier, the turbine may be in one unit on the compressor shaft, or may be divided into two or more sections with some sections driving the compressor and the other the power shaft. Each turbine may be either one or more stages. A single stage turbine aside from its simplicity and low cost has two other very distinct advantages: One, a very substantial temperature drop takes place through the stationary nozzles and before the jet strikes the buckets. Further, the wheel disk can be easily cooled and so run at high peripheral speeds. Both of these factors permit higher initial temperatures to be used than with a multi-stage turbine. These advantages must be offset against the disadvantage of a somewhat lower turbine efficiency than if a multi-stage turbine is used. Much experience will be required before this matter is finally settled.

The variations possible in gas turbine cycles, types, and design are legion; many years will probably pass before they are sorted out, and many will probably survive, each for different applications.

One early type was the explosion gas turbine, and its principal advantage is that it greatly reduces the work of the compressor.

Another early proposal was that the turbine be subatmospheric with the air compressor on the exhaust side after cooling. One advantage being that if water is injected in the exhaust the CO_2 and H_2O would be absorbed and so the work of compression would be reduced.

Neither of these will probably be revived. The possibilities in the constant pressure cycle with different arrangements and amounts of regeneration, intercooling, water injection or steam generation, single or multiple turbines, with or without reheating in between, single and multi-stage turbines, axial flow or constant displacement compressors, furnish a wide possible variety of arrangements.

An interesting gas turbine cycle is being actively promoted by Escher Wyss in Switzerland. This is the closed cycle with external combustion and cooling. As such, the cycle is substantially as shown in Fig. 2, but the cycle is closed using a definite amount of air or gas as the working medium. In place of heating by the internal combustion of fuel, the working fluid is heated by being passed through tubes in a fire box of a furnace, and ahead of the compressor it is cooled by passing over water cooled tubes. The working fluid remains clean, and the capacity of the plant can be changed at will by increasing or decreasing the density of the working fluid in the cycle. The output for a given weight of fluid in the cycle depends upon the heat put into the furnace. The disadvantages are the large amount of high temperature heat exchanger surfaces required, probably 3 to 5 times that of a steam plant, and the very low pressure drops which must be maintained through them. So far as is known to the writer, no efforts are being made in this country to exploit this cycle with external firing.

Combined with Internal Combustion

One field that looks very promising for the future is to combine the gas turbine and the internal combustion engine. This has already been done with great success in the case of the exhaust gas turbine driven supercharger for the airplane engine and the Diesel engine. By increasing the supercharging pressure, the output of the gas turbine can be increased until it is equal to the engine output; under which conditions the engine can, if more convenient or otherwise desirable, drive the compressor, and the turbine the load. In one type of two-cycle Diesel combination it is proposed that the engine drive the compressor which discharges through the engine cylinders at the exhaust position and then into the turbine. The compressed air acts as scavenging and supercharging air at the same time, and the exhaust heat is added to the work done on the air by the Diesel. Efficiencies are said to be possible with good compressor and turbine efficiencies which are substantially higher than that of the Diesel itself. This looks like a very promising combination, and has been built in an arrangement with the Diesel and compressor cylinders on the same rod and without a crankshaft.

•

Effect of Molecular Structure of Fuels

Studies of molecular structure have shown that long thin molecules tend to make internal-combustion engines knock very badly, and short compact ones of the same weight only a little, and that the differences between them may amount to several-fold changes in the potential output of an engine using them. Findings along this line are given in a paper, "The Effect of Molecular Structure of Fuels on the Power and Efficiency of Internal-Combustion Engines", presented by Charles F. Kettering, Vice-President, General Motors Corp., Detroit, before the American Chemical Society in New York.

In this research one compound called triptane (or 2, 2, 3-trimethyl butane) was found years ago to be one of the best fuels, although until then it was only a laboratory curiosity, and had never been made in quantity pure.

The General Motors Research Laboratories recently found a way to make 99 percent pure triptane in tank car quantities, however the manufacturing details are not yet generally revealed because of war secrecy restrictions. Sufficient quantities of pure triptane have been made in a new pilot plant to permit extensive testing, even in airplanes.

It has thus been demonstrated that the gains possible with triptane, especially when lead tetraethyl is added, depend upon the particular engine and conditions of operation, and have amounted to as much as four times the power and a quarter less fuel than is obtained with present 100-octane gasoline.

Load Limits Determined For Distribution Transformers

A method of determining maximum allowable annual peak load of distribution transformers in residential service that will give a predetermined number of years life—Calculations based on history records of transformers that failed due to aging of insulation

PERRY SHELLEY, Oklahoma Gas & Electric Co., Oklahoma City, Okla.*

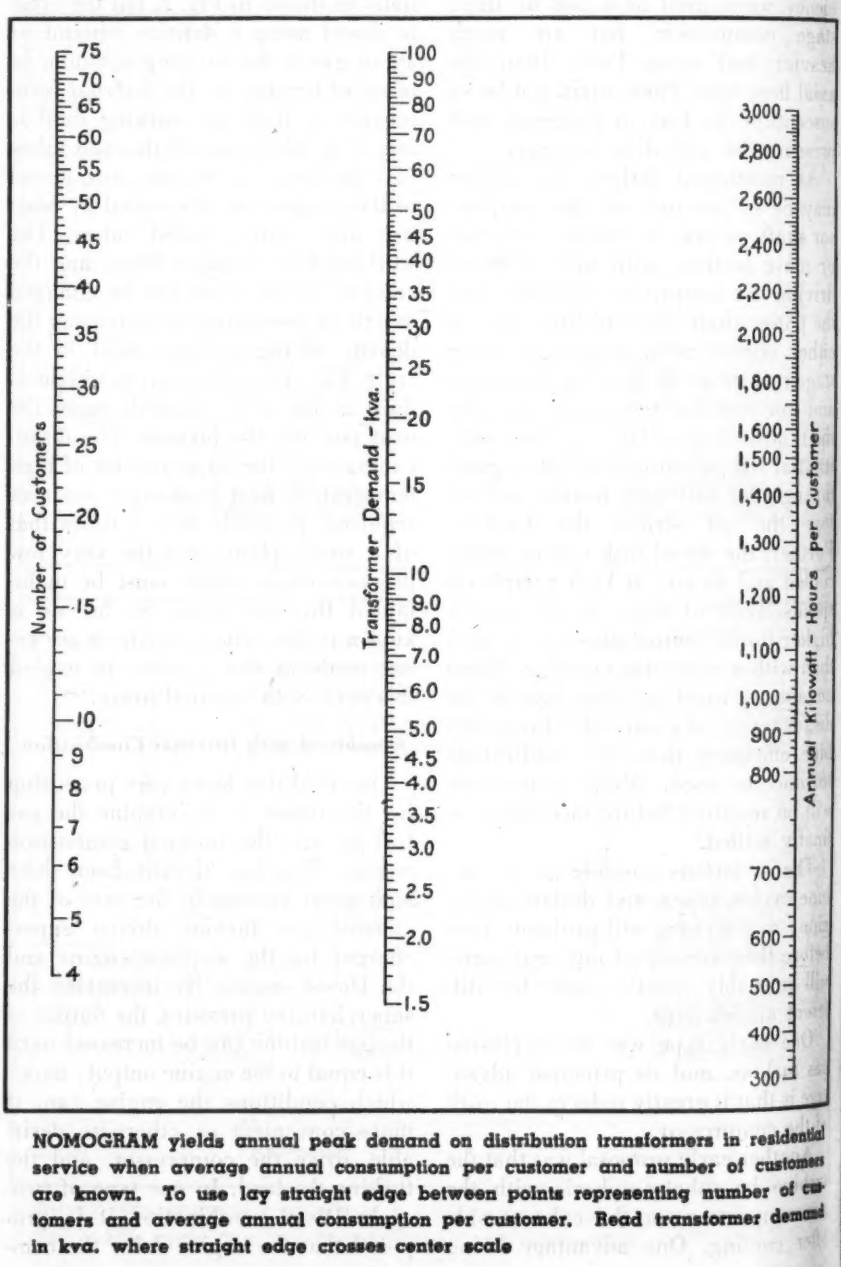
DETERMINATION of the maximum permissible loading of residential distribution transformers that will result in a specific life expectancy has been instrumental in raising the allowable annual peak load limit of transformers on the Oklahoma Gas & Electric Co. system from 120 percent of rating to 140 percent of rating, for units in residential service. This change has had the effect of adding many thousands of kva. of transformer capacity to the system, a result that is especially important at the present time due to wartime restrictions on the use of strategic materials.

The method used in making these studies is based on life history records of transformers that failed in service due to aging of the insulation. For the purpose of this article, the method will be applied to a transformer that had failed in service because of an overloaded condition.

Determine Annual Peak Kva.

Using data from permanent meter reading records it is possible to determine the annual peak kva. load on a transformer serving residential loads if the number of customers supplied and the annual kilowatt-hours consumption are known. A previous article** describes how this is done. A slightly revised nomogram from this article is included herein for purposes of the present discussion.

From the meter reading records and the nomogram, shown, peak loads that



NOMOGRAM yields annual peak demand on distribution transformers in residential service when average annual consumption per customer and number of customers are known. To use lay straight edge between points representing number of customers and average annual consumption per customer. Read transformer demand in kva. where straight edge crosses center scale

* Electrical Engineer, Transmission-Distribution Dept.

** See article "Determine Transformer Load from Customer Records" by Shelley & Wallis: ELECTRICAL WORLD, December 13, 1941, pages 72, 74.

were carried by a transformer in the years prior to its failure can be found. A history so established is useful in determining the maximum allowable loading. Furthermore, maximum permissible loading, thus established, may have greater validity because the loading of transformers in service and the maximum load limit will have been determined by the same method.

Table I shows the loading history, as determined from meter reading records, of a 10-kva. transformer that had a 12-year life. Inspection showed that failure resulted from thermal deterioration of insulation.

First step in converting known facts concerning this transformer to a value of loading that would have resulted in a reasonable life was to select a characteristic daily load cycle from a number of load cycles that had occurred on various transformers, as shown in Figure I.

Curves showing oil temperature rise and hot-spot temperature rise above ambient where constructed for the condition of a daily peak load equal to the transformer rating. The temperature curves were constructed by using the methods and data given in EEI publication No. F-7; the typical distribution transformer being taken as having, at rated load, an ultimate oil temperature rise above ambient of 35 deg. C., an ultimate copper hot spot rise above oil of 20 deg. C., a time constant of 5 hours and a ratio of iron loss to copper loss of 1 to 3.

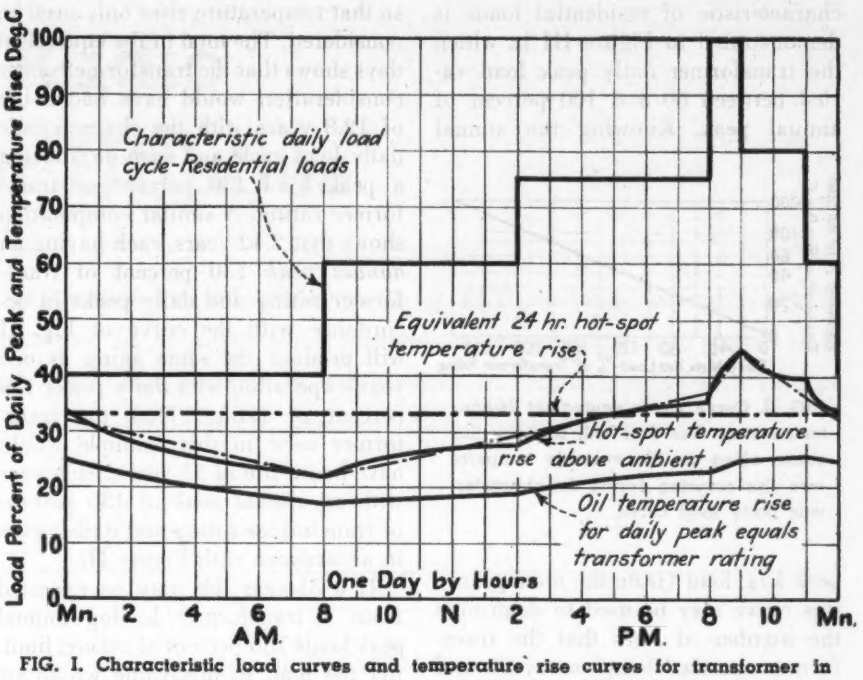


FIG. I. Characteristic load curves and temperature rise curves for transformer in residential service which were selected from a number of load cycles

The hot spot temperature rise curve was approximated by straight lines and the equivalent 24-hour hot-spot temperature rise was computed using the method given by Montsinger.‡ The equivalent 24-hour hot spot temperature rise was likewise computed for various other values of transformer daily peak loads between 100 and 200 percent of rating, using the same characteristic daily load cycle. These values lie along a straight line when plotted against maximum kva. load on semi-log paper as shown in accompanying Figure II. The equation of the curve is:

$$\theta = 10.7\, e^{1.11L}, \text{ in which}$$

θ is the equivalent 22-hour hot-spot temperature rise in degrees C above ambient and L is the per-unit daily peak load based on the transformer rating.

This curve may be used to find the equivalent 24-hour hot-spot temperature rise for any value of daily maximum kva. load with the same characteristic daily load cycle.

Tests on individual transformers reveals that the annual peak load occurs only a few days out of the year. This

Table I

Life History of 10-Kva. Transformer

Period	Average Number Of Customers	Consumption Average Annual Kwh. Per Customer	Peak Kva. Load For Period (From Chart)	Peak Kva. % Of Transformer Rating
Oct. 1930 to Oct. 1931			7.5 (Est.)	75
Oct. 1931 to Oct. 1932	37.4	490	8.0	80
Oct. 1932 to Oct. 1933	37	527	8.4	84
Oct. 1933 to Oct. 1934	43.6	597	10.2	102
Oct. 1934 to Oct. 1935	45.7	579	10.7	107
Oct. 1935 to Oct. 1936	51.1	727	14.0	140
Oct. 1936 to Oct. 1937	52.2	693	13.4	134
Oct. 1937 to Oct. 1938	52.3	694	13.4	134
Oct. 1938 to Oct. 1939	51	830	17.3	173
Oct. 1939 to Oct. 1940	56	780	17.0	170
Oct. 1940 to Oct. 1941	50.6	872	18.0	180
Oct. 1941 to Oct. 1942	51.0	791	16.0	160

Table II

Computation of Transformer Life with Daily Peak Load 130% of Transformer Rating and Equivalent 24 Hour Hot Spot Temperature Rise $T_o = 45°$ C

Load Range %	A_o No. of Days Operated	Equivalent 24 Hour Temp. Rise T_o °C.	$T_o - T_s$	$(T_o - T_s)$ Times .0866	$e^{.0866\,(T_o - T_s)}$	A_x quivalent Days With 130% Peak Load
40- 50	11	18	−27	−2.34	.096	1
50- 60	193	20	−25	−2.16	.115	22
60- 70	602	22	−23	−1.99	.137	83
70- 80	438	25	−20	−1.73	.177	78
80- 90	336	28	−17	−1.47	.230	77
90-100	350	31	−14	−1.21	.298	104
100-110	332	35	−10	− .87	.419	139
110-120	478	39	− 6	− .52	.594	284
120-130	452	44	− 1	− .09	.914	413
130-140	398	49	+ 4	+ .35	1.42	565
140-150	372	54	+ 9	+ .78	2.18	812
150-160	296	60	+15	+1.30	3.67	1085
160-170	98	67	+22	+1.90	6.68	655
170-180	18	75	+30	+2.60	13.46	242
						4560

$\frac{4560}{365}$ = 12.8 years life—each day having peak load 130% of transformer rating.

12.8×2.42 = 31 years life with each year having annual peak 130% of transformer rating and daily peaks in accordance with frequency curve of daily peak loads.

‡ See "Transformer Limits for Short Time Overloads for Oil Insulated Neutral Grounded Devices" V. M. Montsinger. AIEE Transactions. 1938

characteristic of residential loads is demonstrated in Figure III in which the transformer daily peak load varied between 60 and 100 percent of annual peak. Knowing the annual

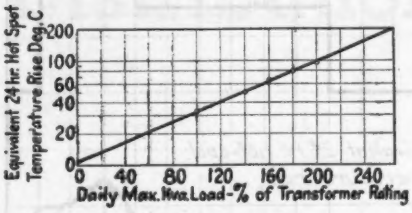


FIG. II. Curve yields equivalent 24-hour temperature rise that will produce the same aging as the variable temperature rise occuring during the characteristic daily load curve

peak kva. load (from the nomogram) this curve may be used to determine the number of days that the transformer operated between say 90 and 100 percent of rating or any other load range desired, each year.

This curve was applied to the annual peak loads of Table I and the number of days in each year that the transformer operated within the various load ranges were determined; the load ranges being taken as 10 percent of the transformer rating. The total number of days that the transformer operated within the various load ranges is shown in Table II, the second column. The equivalent 24-hour temperature rise for each load range was then selected from Figure II. It is now possible to compute an equivalent number of days for each load range. Each equivalent day thus computed has a peak load 130 percent of transformer rating and a 24-hour equivalent hot spot temperature rise of 45 deg. C. The same amount of aging takes place during the equivalent days as occurred during the actual days operated.

8-Degree Rule

The computation is based on the 8 degree rule, which states that the aging of transformer insulation is doubled for each 8 deg. C. increase in temperature. This rule may be used to derive the formula:

$A_x = A_o\, e^{0.866\,(T_o - T_x)}$, in which

A_o is the number of days operated with a hot spot temperature rise of T_o degrees C and A_x is the number of days, at some other hot spot temperature rise T_x degrees C, that will produce the same aging as occurred during the A_o days.

This is based on the ambient temperature being equal in both cases, so that temperature rises only need be considered. The total of the equivalent days shows that the transformer under consideration would have had a life of 12.8 years with the characteristic daily load cycle and *each day* having a peak load 130 percent of transformer rating. A similar computation shows that 2.42 years, each having an *annual peak* 130 percent of transformer rating and daily peaks in accordance with the curve of Fig. II will produce the same aging as one year's operation with *daily* peaks 130 percent of rating. Thus the transformer used in this example would have had a life of 31 years, each year with an *annual peak* of 130 percent of transformer rating and daily peaks in accordance with Figure III.

If a 31-year life may be expected from a transformer having annual peak loads 130 percent of rating, limiting the load to this value would result in a much longer life than in the actual case, since transformers are usually installed at some lower value of loading, experience a certain annual growth, and finally reach the changeout point. As a result of these considerations the company has raised the changeout point to 140 percent of transformer rating for transformers serving residential loads.

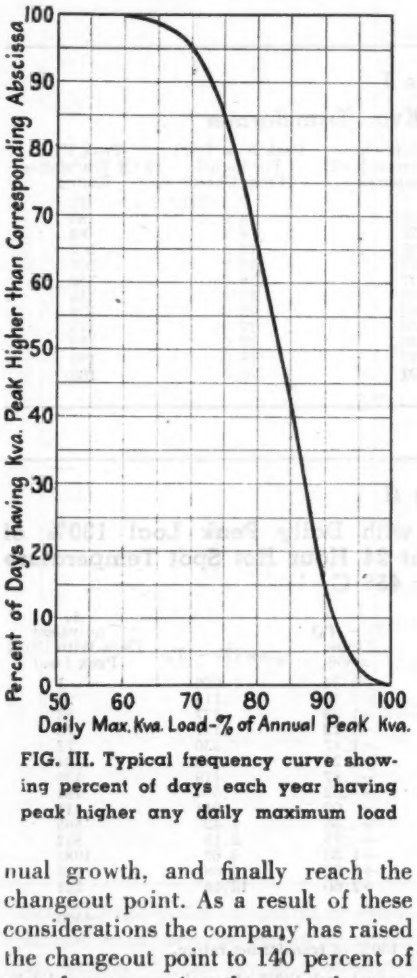
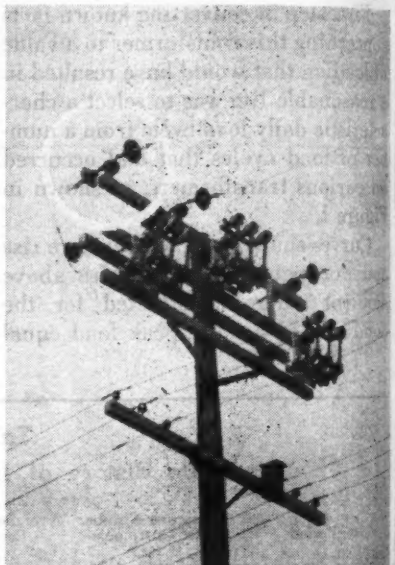


FIG. III. Typical frequency curve showing percent of days each year having peak higher any daily maximum load

Simplified Pole Top Fuse Installation

Cost of dead-ending a 13.8 kv. line at a point where it was desired to install three-shot high interrupting capacity fuses was cut approximately in two recently by the use of the illustrated rather novel single-arm construction on the system of the Central Illinois Electric & Gas Co. system, Rockford, Illinois.

To provide the break in the continuity of the conductor, necessary for the installation of fuses, single



EXTENSION link and insulator assembly tied into a deep-groove pin insulator permits use of single arm instead of double arm construction where three-shot fuses are cut into 13.8 kv. line

disc strain insulators were attached to opposite ends of an O-B extension link. The link and insulator assembly, with conductors attached, was tied in the top groove of a pin-type insulator on a conventional single arm. Since the diameter of the extension link is $\frac{3}{4}$ in. it was necessary to use the pin-type insulator with a $\frac{1}{2}$-in. deep groove in order to secure a firm fastening.

This construction avoided the more costly double-arm construction with the insulators and hardware fittings for the conventional 13.8 kv. dead-end construction commonly used in such cases. The design as shown in above illustration is the work of J. J. Graven, distribution engineer of the Rockford power company.

Emergency Radio Channels for Utilities

Presentation of industry's needs at FCC hearing forecasts urgent increase in channels and latitude in competition with other non-governmental services in communication, transportation and similar agencies—Not enough channels—Some may have to yield

H. L. DAVIS, Jr., Philadelphia Electric Co., Philadelphia, Pa.

ABOUT ONE YEAR AGO, the FCC felt it should have the advice of industry regarding domestic views on the future of radio. This assistance from industry would be of value to the Commission in formulating its recommendations to the State Department and for its guidance in future allocation. Upon the suggestion of the Commission, the Radio Technical Planning Board was organized. This board, composed of radio manufacturers, present users of radio services, and prospective users of radio, has put more than 700 people to work in order to draft plans for the future of the radio industry in all its phases.

Work of RTPB has been distributed among 13 panels and specific interests of the electric light and power industry come under Committee 4 of Panel 13.

This Committee has prepared a report and has arranged to represent the electric, gas and water utilities in the FCC hearings, which began September 28th. The report presents a complete case in support of the use of radio by these services.

There are 56 electric and gas utilities, with an investment of approximately $3,000,000 in radio, operating a total of 857 transmitters. More than 700 of these are in the emergency service of electric utilities.

Progress of pre-war radio emergency service, and the figures that have been used as a basis for estimating the future demands in the immediate postwar period are given in Table I.

Post-War Use

On the basis of the survey, it is estimated that 150 electric and gas companies will use radio in the post-war period. These companies supply 50 percent of the total electric and gas customers in the country. The data indicates that the power utilities, when water company requirements are added, may expand their installations to some 5,500 transmitters under present FCC regulations, and to perhaps 10,000 transmitters if these regulations are relaxed. Thus, it is expected that service may be expanded between six and twelve times the present use. This compares with an expected growth by police of approximately 10 to 1.

Table I

Past and Prospective Growth in Radio Usage by Electric and Gas Groups

		No. of Licensed Transmitters		
	Companies Using Radio	Fixed	Portable and Mobile	Total
June 1936	10 Est.	...	...	25 Est.
May 1944	56	166	691	857
Post-War Present Regulations	77	456	3021	3477
Relaxed Regulations	85	831	5384	6215

The present FCC hearings are for the purpose of establishing an allocation plan for the spectrum from 10 kc. to 30,000 mc. This upper limit is far beyond anything considered practical before the war. However, war developments indicate that practical operation is now feasible up to 10,000 mc. and experimental work indicates that within a very few years the 30,000 mc. channel may become active. Therefore, RTPB has been asked to estimate not only the extension of present use, but also the projected new uses of radio. The Committee has attempted to do this for the power utilities and has made provision in its request for channels to permit the use of radio for—(a) automatic relaying of radio transmission for the purpose of range extension or to overcome the shadow effect of intervening obstructions; (b) performance of power system operations such as the control of remotely located apparatus; (c) the automatic transmission of metering of alarm signals vital to the proper operation of power system facilities; (d) the more effective direction and conduct of complex field operations. Walkie-talkie or handy-talkie units are contemplated for this service.

One of the proposed new uses cited in the report is a practical means of controlling several remote hydro-electric plants or substations from a centrally controlled point by using four to six beamed channels operating at frequencies above 100 mc. The system will provide continuous indication at the control point of conditions at the remote plants and will afford the central operator full control over the major items of equipment.

* Adapted from paper at recent meeting of Edison Electric Institute, transmission and distribution committee at Buffalo.

This is not a hypothetical case, but one which has been developed in co-operation with a manufacturer and seriously considered by an electric utility in New York State.

Committee 4 is asking for 79 channels to be made available to the power utilities. This compares with 17 channels shared today by some 15 or more services qualified as special emergency.

Table 2 shows the location of present and proposed channels:

Table II

Power Utilities Radio Emergency Service Present and Proposed Channels

Region	Number of Channels Today	RTPB Request
MF (0.3-3.0 mc.)	2	3
HF (3-30 mc.)	2	3
VHF (30-300 mc.)	13	53
UHF (300-30000 mc.)	..	20
Total	17	79

Of some 1,300 special emergency stations now operating, the power utilities operate over 800 or nearly 65 percent of the total.

Channel Requirements

The problem of channel requirements was approached from a strictly realistic viewpoint. In the MF and HF regions studies were made of the Southern California area and the Pacific Northwest region, both of which are considered typical "extensively mountainous areas." The six channels requested in this region will also serve the middle west pipe lines, the long distance transmission necessitated by Florida hurricanes and in the east where distance and hilly country are major factors.

In the VHF five studies were made of hypothetical requirements for point to mobile service. Two of these were by the electric group and covered New York City and the Cleveland-Pittsburgh areas. Within a 50-mile radius of New York City with minimum channel requirements to permit the use of radio by all without serious interference, a study indicates that 9 fixed and 9 mobile channels will be required. In the western Pennsylvania-Eastern Ohio area, a similar study also indicated a total of 18 channels. It is felt that such areas are reasonably representative of the congested sections of the country.

As a result of such studies, the Committee estimated the channel requirements for services within its jurisdiction as follows:

Electric Group—51 channels; Gas Group—37 channels; Water Group—19 channels, making a total of 107 channels. However, on a diversified basis, assuming these three groups could share channels where geographical conditions permit, it was found that 79 channels would be required as the minimum number necessary to provide satisfactory service. The power utilities committee is prepared to support the request for these channels.

Radio and Television

From the foregoing it may be felt that Committee 4 may be over-optimistic or that the possibilities of radio are greatly over-estimated in the utility field. By comparison with other services, this is a small program.

Both FM broadcasting and television are expecting large blocks of channels for setting up their services. International communication and aeronautical services are also demanding a great number of *must* channels. These are *new* services which will have to be accommodated in the new scheme of allocation.

In the portable mobile and emergency field the police are asking for 333 channels for speech, telegraph, facsimile repeaters, remote transmitter control, aircraft, walkie-talkie and handy-talkies. The fire service want 34 channels for point to mobile, point to point, and walkie-talkie services. Forest and conservation has requested 47 channels. The taxi cab industry wants 45 channels for dispatching service. The railroads are seeking 84 channels for various uses, such as front to rear of train, train to dispatchers, construction, and closing openings in their wire lines due to washouts, storm trouble, etc. Telephone utilities are requesting 220 channels for common carrier service. The telephone program provides fixed to mobile service for all who will be willing to pay for it. The service will be available to doctors, farmers and campers in remote locations, truckers, and utilities. The service will make it possible to reach any mobile unit equipped with radio from any telephone on the Bell System. The bus people are proposing a radio dispatching system and signal system for headway recording. These are only a few contending for the spectrum space.

Some Must Yield

The demands for channel space are enough to cause serious over-crowding. Some services, no doubt, will be cut. Extending the spectrum from 300 mc. to 30,000 mc. has not made enough room for all who would like to get in.

In the 30 to 40 mc. band, IRAC wants 49 percent of the channels for government service. Non-federal needs have requested 97 percent of this block. The requests total 146 percent of the available channels. For the spectrum as a whole, the requests are for almost 200 percent of the 10 kc. to 30,000 mc. space.

Obviously somebody is going to be left out.

Panel No. 2 of RTPB is working to reconcile the demands of non-governmental agencies, so that RTPB can present a plan without serious overlapping of services. Industry's position as developed by the FCC will have to be coordinated with that of IRAC.

Power utilities striving to hold the 17 channels they have and to obtain a just share of the spectrum for emergency service consistent with the demands of others.

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Preparation for Treating Cable Rash

Solution for treating cable rash which comes from contact with waterproof and fireproof cable impregnated with chlorinated napthalene, chlorinated diphenyl or chlorinated diphenyl oxide has been devised by T. P. Connelly and W. C. March and reported in *U. S. Naval Medical Bulletin* 42:403, 1944.

In treating this condition, these physicians recommend nightly application of the following preparation after thoroughly cleansing the skin with soap and water.

(The solution is to be washed off in the morning).

Potassium sulfide (50% solution, filtered) ..... 60.0 cc.
Zinc oxide ..... 30.0 gm.
Precipitated sulfur ..... 30.0 gm.
Glycerine, C. P. ..... 5.0 cc.
Soluble fluid rose ..... 1.0 cc.

High-Frequency Heating of Non-Metallic Materials

High-frequency electric field heating offers a new tool for rapid, accurate, and uniform heating of non-metallic materials having low thermal conductivity—It offers effective means of heating materials when heat transfer from external source is difficult or impossible

THERE IS NO MAGIC in high frequency electric field heating. Nor, in fact is the principle upon which it works entirely new or unfamiliar to engineers. Its newness lies in the fact that through it a productive use has been found for the notorious dielectric losses of a condenser.

For, electric field heating, springing up today as a new industrial tool for heating non-metallic materials, merely uses high frequency and moderately high voltage to increase the heat energy released as dielectric losses within work material constituting the dielectric of an external condenser. Heat energy so released *within* the work or "dielectric" is sufficient to raise its temperature to levels required to set glue, soften plastics, or bring about various chemical reactions.

In this new heating process heat is not transferred to the material from an external hot body but is *generated within* the material itself by the repeated stressing that it receives as a dielectric in the rapidly changing electric field between the plates of a condenser operating at high frequency. Result of this stressing is molecular distortion and heat. By raising the frequency to several million cycles per second and the voltage to a few thousand volts, this rate of molecular distortion is increased appreciably over that at normal frequency and voltage. As the rate of change of the electric field producing this distortion increases, the heat from the dielectric losses is increased.

The basic advantage of high frequency dielectric heating is its ability to heat the complete mass of work material between condenser electrodes uniformly. Gone is the old bugaboo of heat transfer in many industrial heating problems involving materials of low thermal conductivity, such as wood and plastics, that made it difficult or impossible to produce the desired temperature rise uniformly through the section in the required time. In dielectric heating the uniformity of heat release within the material is limited only by the uniformity of the material and the electric field in which it rests. Thermal conductivity is entirely eliminated as a factor in the problem.

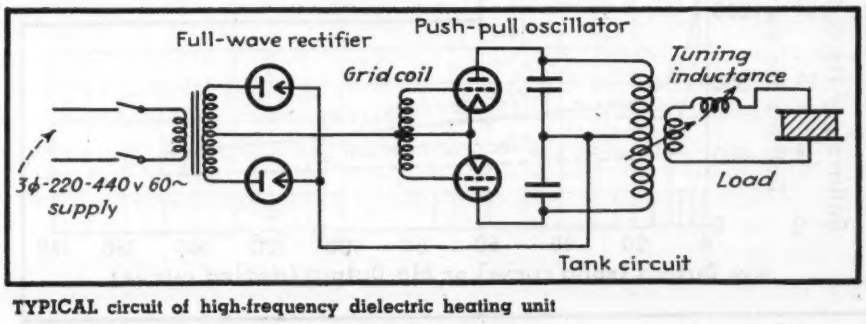
Basic Circuit

A variety of electrical circuits have been used in dielectric heating apparatus but the one shown is typical of the general purpose circuit used by the Thermex Division, of the Girdler Corp., Louisville, Ky. Other manufacturers of similar apparatus are: Federal Telephone and Radio Corp., and Radio Corporation of America.

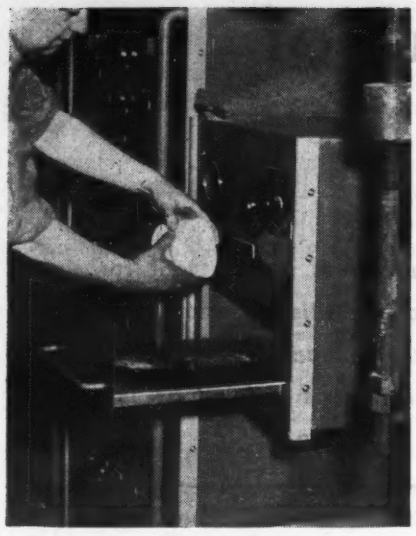
For simplicity this circuit is shown single-phase although most equipment, with the exception of smaller sizes, is three-phase. In its elements the circuit consists simply of a transformer, full-wave rectifier, push-pull oscillator and tank circuit connected to the external condenser electrodes through coupling coil and tuning inductance.

The typical machine is supplied at 220 or 440 volts, three-phase. Power is brought in through a supply circuit breaker to a center-tap transformer that steps voltage up about 10,000 volts. A full-wave mercury vapor tube rectifier circuit converts it to d.c. that is supplied to a push-pull oscillator which boosts frequency to 1,000,000 to 10,000,00 cycles in the tank circuit. A coupling coil connects the tank circuit with the external circuit through a variable inductance that tunes the external circuit to resonance with the tank circuit. Material to be heated is placed between the electrode plates to form the dielectric of the work condenser.

Thermex units are made in output sizes ranging from 500 watts to 300 kw. (1,700 B.t.u. per hr. to 1,000,000 B.t.u. per hr.). Overall efficiency of the circuit is about 50 percent; slightly higher in the larger unit sizes, lower in smaller equipment. The losses occur in rectification, tube heat dissipation, circuit resistance and filament heating, air blowers and water pumps. Taking into account



TYPICAL circuit of high-frequency dielectric heating unit



DESIGNED expressly for heating plastic preforms this high-frequency unit is installed between two transfer presses and accommodates the output of both

the circuit efficiency, input rating of units ranges from 1 kw. to 500 kw.

Power factor of dielectric heating units is generally high, around 90 percent. The smaller units have the lowest power factor. No power factor correcting capacitors are installed in the equipment nor are they necessary.

Although the voltage across the electrodes of the work condenser are of the order of 10,000 to 25,000 volts, the high order of the frequency reduces the hazard considerably. Contact with the electrodes, while it will draw an arc that will cause a painful surface burn, is not lethal. As a precaution, however, the load condenser is usually enclosed in a cage interlocked to trip off the supply breaker when not in the protecting position.

Fundamentally the magnitude of the dielectric losses of a condenser are given by the equation:

$$W = E^2 \times 2\pi \times f \times C \times pf.$$

in which W is the loss in watts, E is the RMS voltage across the condenser plates, f is frequency in cycles per second, C is the capacity of the condenser in farads and pf. the power factor of the dielectric material at the frequency under consideration. This equation can be used to determine the heat release rate within the material being subjected to dielectric heating.

Capacity of the work condenser can be determined from its physical dimensions, the thickness of the dielectric and its specific inductive capacity by the expression:

$$C = \frac{A \times 0.224 \times E}{H}$$

in which A is the sectional area of the dielectric in a plane parallel to the condenser plates, E is the specific inductive capacity of the dielectric at the work frequency and H is the thickness of the dielectric in inches.

Combining the above two equations and substituting K for the product of pf and E we attain

$$W = \frac{E^2 \times 1.41 \times f \times A \times K}{H}$$

It should be noted that the K is a constant, given in physical tables as dielectric loss factor. For a given heating problem A and H will also be constants depending on the work material. Thus E and f remain the two variables which control the rate of heat release in the dielectric.

The use of high values of frequency in dielectric heating apparatus of the order of 1 to 10 megacycles permits the same heat release to be obtained with apparatus using moderate voltages of the order of 10,000 to 25,000 volts as with apparatus using higher voltages and lower frequency. This selection of higher frequencies simplifies machine insulation problems and contributes considerably to safety.

When the output rating of the unit is known in kilowatts or B.t.u. per hr. (one kw. is equivalent to a heat release rate of 3,413 B.t.u. per hr.) relatively few calculations are required to determine the length of time required to raise the temperature of a piece of work a given amount in a specified time. The B.t.u. required to raise the temperature of work is given as

$$B.t.u. = Lb \times S.H. \times T_2 - T_1$$

where Lb is the weight in pounds, $S.H.$ is the specific heat and $T_2 - T_1$ is the desired temperature rise. If the output capacity is W kilowatts the batch time (in minutes) will be

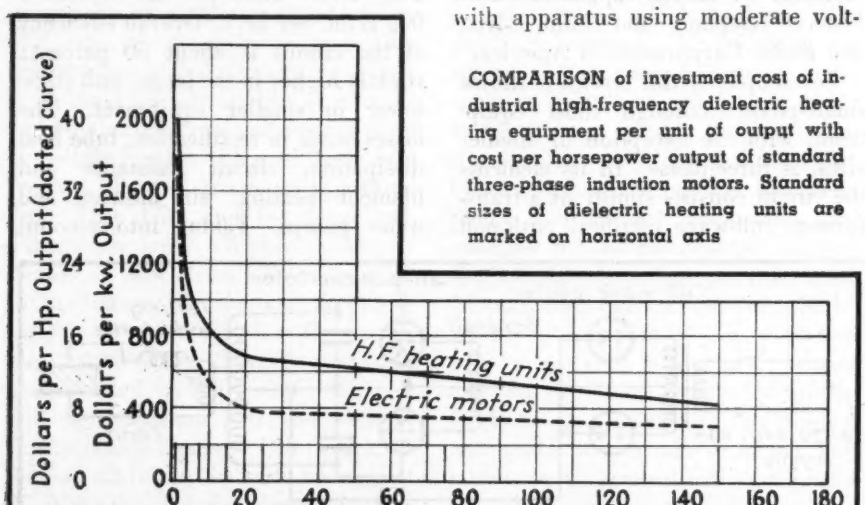
$$\text{Batch time} = \frac{Lb \times S.H. \times (T_2 - T_1) \times 60}{W \times 3413}$$

Present Applications

Electric field heating will probably not be able to compete successfully with electrical resistance heaters in applications where heat transfer from an external source is no problem. Its overall conversion efficiency of 50 percent compares unfavorably with the 100 percent conversion of electric energy to heat in resistance units for such applications. However, where low thermal conductivity is encountered particularly in non-metallic materials, resistance heaters are under a handicap that dielectric heating overcomes, through its ability to produce its heat inside the material, uniformly and rapidly.

Wood—By far the widest present application of dielectric heating has been to the lamination of wood in the production of plywood and compreg wood. In this application dielectric heat provides uniform heat distribution through material of notoriously low thermal conductivity. It is accomplished moreover without overheating the surface or driving moisture from the outside panel surface in a manner to produce uneven moisture distribution and warping.

With high frequency heating, advantage can be taken of the new waterproof, heat-setting synthetic resin glues which are unaffected by salt water and will not delaminate. Moreover, the cold setting urea base glues



COMPARISON of investment cost of industrial high-frequency dielectric heating equipment per unit of output with cost per horsepower output of standard three-phase induction motors. Standard sizes of dielectric heating units are marked on horizontal axis

may also be used with high frequency. The same urea base glues that take 8 hours to set at 70 deg. in a cold press can be polymerised in under 8 minutes with high frequency heat.

In laminating wood high frequency is normally applied to a stack of glue coated veneer sheets in a press under pressure. The usual arrangement is to connect one terminal of the high frequency unit to a plate electrode sandwiched into the pile of veneer sheets about midway in the stack. The other terminal of the unit is attached to the grounded press frame so that its upper and lower platens become electrodes of the condenser. Layers of veneer up to 2 ft. or more in thickness can be heated in this way with the larger size units.

An important point in the laminating of wood with high frequency heat is that when the glue has polymerized the stack of laminated panels can be removed from the press and stored for shipment without the "curing" period under pressure, required with cold press operation to equalize moisture distribution through panel section.

It is not always necessary that glue lines be parallel with the electrode plate. Considerable power and time can sometimes be saved in laminating large curved pieces such as airplane spars by having the glue lines perpendicular to the electrodes and parallel with the electric field. This method has the advantage that most of the power will be absorbed by the glue line rather than the wood itself.

Plastics—In the field of thermosetting plastics dielectric heating has been most widely applied to preheating preforms for compression and transfer moulding of urea, melanine, phenolic and other resins. Almost any filler may be used, such as; wood flour, shreaded paper, chopped cloth, asbestos or powdered mica. Its heat has also been applied to polymerize laminated paper, cloth and other sheet plastics.

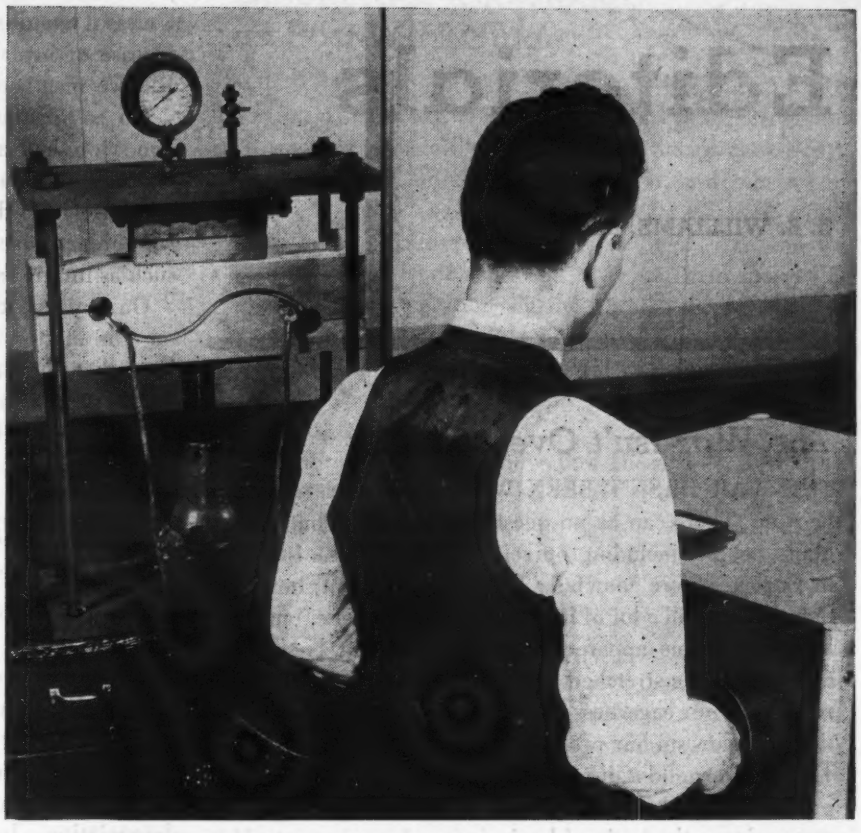
Through its ability to secure uniform temperature distribution quickly throughout the preform, without overcuring outer surfaces it has been possible in practically all cases to double production of existing press and mold equipment by changing from external to high frequency preform preheating. Moreover because the preform is softened uniformly throughout, the plastic flows more freely in the mold without the need for extreme pressure to secure this end. Thus mold closing time can be cut to 10 to 30 percent of previous values, pressures have been reduced to as low as 20 percent of former values, and larger weights of molded material handled.

Textiles—Dielectric heating is also being used to set the twist in corded materials and to cure the finish on fabrics. Experimental work is being done on the drying of fabrics on a continuous basis.

Rubber—High frequency heat is effective in preheating preparatory to molding both natural and synthetic rubber compounds. It offers a means of securing more uniform curing. Dielectric heating avoids the tendency of conductive methods to over-vulcanizing at the surface in order to secure proper curing at the center.

A few of the other proven applications of high-frequency electric field heating include: Heating of cellulose fiber, drying paper, drying powders, heating of oxides such as Alundum and Carborundum, softening of celluloid, binding granulated cork for making gaskets and linoleum, killing insects in grain. Many other applications exist that are not practical to list in a survey article of this type.

However, a large part of the field of usefulness of dielectric heating remains to be explored in terms of specific applications. This exploratory work will be done when war restrictions are lifted and the equipment becomes easily obtainable by anyone who wants to try it out on his particular production problem. Then dielectric heating will find its place in industry on the basis of cost and performance the same as any other technique.



HIGH-FREQUENCY heat is being applied here through thin sheet electrodes to a curved section of plywood; forming the curve between wood blocks and bonding the veneers in a single operation at high speed

Power Factor and Dielectric Constant of Materials Ordinarily Handled by High Frequency Dielectric Heating Equipment

These values are to assist in distinguishing power factor and dielectric constant of materials. All values are for one megacycle.

	Power Factor	Dielectric Constant
General purpose wood-flour phenolic molding material	0.04	3.5
Wood	0.035	3.0
Neoprene Rubber	0.06	12.0
Buna N	0.17	9.0

Note: The electrical characteristics of the materials mentioned above are approximate and vary considerably with changes in density, moisture content, etc. High frequency dielectric heating equipment can be successfully applied to those materials having very broad ranges in electrical characteristics.

Editorials

S. B. WILLIAMS, *Editor*

The War Isn't Over Yet

THE WAR HASN'T BEEN WON YET. It is going to be won. There can be no question about that, but when? Many people, including ourselves, had visions of victory in Europe before snowfall. It is now apparent, however, that there is still a lot of hard fighting to be done, but what has not become apparent to the home front is that the fighting can be stretched out for another year or perhaps more if in our eagerness to get back to peace-time occupations we slow up our production of essential war supplies. There are around a dozen items that are critical, on which production is below requirements. Military objectives are made on the basis of having enough equipment. If it is in insufficient supply the speed with which the line moves forward is reduced and a longer time is required. Production of some items has been curtailed because the supply seemed ample for the time thought necessary to complete the job in Europe. If for any reason this time has to be lengthened we may find a number of new critical items.

If we do not move into reconversion as rapidly as had been expected a few weeks ago the reason will be the situation just described. Materials for the most part are in comfortable supply, but manpower is not. Every effort, therefore, will be made to discourage workers from moving off war work back into peace-time occupations.

This is very much like the seventh round in a prize fight. The favorite has his opponent on the rope, but if he can't get a knock-out the fight can go to the end with no decision. Our fighting forces can't deliver the punch without the supplies.

Co-ops as Utilities

IN ILLINOIS rural electric co-ops are now held to be public utilities if they supply service to the public regardless of whether or not they recognize the jurisdiction of the Illinois Commerce Commission. It is difficult to see why co-ops object so to coming under state regulation when they go outside their membership for customers.

If a co-op objects to coming under state regulation it loses certain things, such as the right to intervene in the parcelling out of territory where the commission has jurisdiction over the issuance of certificates of necessity. Unless it complies with state rules it has no leg to stand on in case of injury from structures as the result of storm. Its own members have no way of checking the operation.

No co-op that is operating fairly and wants to do a good job has anything to lose by coming under state regulation. It can have no objection to fair rates or proper accounting. If this be true we are led to believe that those who object have perhaps something to protect or to hide, such as unfair rates to the non-members.

One by one the state commissions are taking a stand on this matter. The co-ops must understand sooner or later that they are private bodies and that they cannot escape regulation if they go outside their own members for customers—if then.

It Depends on Who Is Selling

IT IS INTERESTING to note that while federal regulatory bodies are insistent that original cost is the only proper value of utility property for rate-making purposes RFC has an entirely different viewpoint when it comes to disposing of surplus war plant. In this case RFC recognizes that much of the plant could be built after the war for less money and, taking a realistic point of view, it proposes to sell or lease on the basis of reproduction new less depreciation. In fact, if it didn't take this point of view it probably couldn't dispose of very much property—and some indication of how much there is can be had from glancing at the list of surplus war power plant printed on an earlier page in this issue.

Can it be true that it makes a big difference who is selling and what—government selling surplus plant or utilities selling power—or does it mean that the government chooses whatever means will satisfy it at the moment? Or is this a forerunner of another change in front on the part of regulation when it becomes apparent, as it did to RFC, that reproduction new will give a lower figure than original cost? While we speculate on these questions we can be certain that the government goes to no great pains to inform the right hand what the left hand is doing.

New York City Boycott Upheld

IN THE ABSENCE of preventive legislation, a union can under our laws regulate the sale of electrical equipment in any city to suit itself and nothing can be done about it. That virtually was the decision of the Circuit Court of Appeals in upholding the right of New York City Local No. 3, I.B.E.W., to boycott manufacturers and limit sales in its jurisdiction to such products as are made locally by union manufacturers regardless of the fact that the public pays a higher price.

This case which has been in the courts for nearly nine years was a reversal of an earlier decision by the Federal District Court. It virtually places in the hands of

organized labor complete domination over all electrical supplies that go into the city. It guarantees a market without molestation to the local manufacturers and as a further reward for signing up with the union it gives them a higher price, which the public must pay for the privilege of not having a free market in which to buy.

This is one of the most glaring cases of restraint of interstate trade, but because it involves a trade union the courts appear to be powerless to prevent it. Obviously this restriction is against the public interest, yet by this decision any local union can control the local market and demand its tribute. When business does anything that affects the public interest adversely the courts will go through the most tortuous reasoning to find a restraining reason. With labor the offender, are the courts less mindful of the importance of protecting the public interest?

The Need for Studying Load Diversities

DISTRIBUTION ENGINEERS are beginning to sense the importance of having a knowledge of the behavior of different loads so that they may know their diversity and be in position to provide adequate distribution in advance of the sales department. It's time that this problem was more widely recognized and a great deal more work done on it. Earlier in the year we suggested that the industry underwrite a load behavior research fund, but we made the mistake in directing our suggestion to the commercial people.

After the war new loads can be expected and some of the older loads that never reached large totals may receive intensive promotion. This will be true particularly on residential and rural circuits. The engineers being realists will want to be ready for these loads, but more than that they can provide the information by which selective selling can become a reality instead of just a slogan. A comprehensive knowledge of the diversity of major loads on any system cannot help indicating kinds of load needed to improve net income and perhaps point the way to some new kinds of promotional rates. It is also possible that such studies might indicate the futility of promoting certain loads in certain places.

The distribution engineers and the commercial department are jointly responsible for providing net income. The first step, however, must come from the engineers because the investment is in their hands. It is no longer going to be possible to build greatly in advance of load because the need for lower rates is going to demand greater use of property. If lines are to be properly loaded to give the best load factors then someone must find out how loads behave.

The last place for great savings in utility operation is the investment not only in first cost but in use cost. If just the right amount of investment is to be provided at all times, someone must know load diversity pretty accurately. Then and only then can load be sold selectively.

Opinion vs. Knowledge as Post-War Guide

FOR NEARLY THREE YEARS there has been no production of electrical appliances. The fact that "you can't get another one now" has inspired extraordinary efforts on the parts of utilities, manufacturers and others concerned to teach users how to take care of their appliances and to train people to repair them. In the collective experience of users and of repair men in keeping appliances in operation during these war years, there must reside a considerable body of knowledge on their design and performance that would be useful to manufacturers as they prepare to supply the demands of the post-war market.

Hardly a day passes now that there does not flutter down on the editorial desk a report of a survey made by some publication, advertising agency or trade association to determine what the public will want to buy when war saving's bonds are transformed from something to pay for into something to spend. What will women want in their kitchens; what will people look for in the homes they'll build or buy or remodel after the war; what will be the popular desires in automobiles, in kitchen sinks, in heating plants, in plumbing facilities, in packaged foods, in refrigerators, in cooking equipment, in anything and everything that is contemplated for the mass market.

All of these surveys, these attempts to see into the public mind, are concerned with tomorrow. The questions included in them are mostly invitations to prophecy. They are hypothetical questions the replies to which stand on assumptions that may or may not be within the knowledge or experience of the replier.

When Mrs. Jones is asked whether or not she'd like to have a light in the oven of her post-war electric range so she can see how her cake is doing, she thinks that would be very nice and she votes for it. But she has never cooked in an illuminated oven and she does not know if it's a worth-while thing or if it will turn out to be just an added and possibly troublesome gadget. There is a pretty big "if" in Mrs. Jones's vote for an oven light.

But there are no "if's" in her knowledge of the electric range she is now using. She knows that the oven heat control went wrong once and her cake fell and she waited two days for a repairman to come and he did not have the right repair part in stock and he had to order it from the factory and it was three weeks before she could do any baking. It is quite possible that what Mrs. Jones knows about her range will cause her to turn it in on a different make as soon as she can.

What users have learned about the performance of electric appliances in these war days and what repairmen have discovered of good and bad about their design and contruction should be information mighty useful now to appliance manufacturers. Probably some are rounding up such information. It is a safe bet that those who are will have generally better post-war products.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Who Will Get Surplus War Plant Power Capacity?

THE SITUATION with regard to the disposal of surplus war property is as obscure as any income tax form ever devised, but it becomes increasingly clear that the disposition of the power generating capacity included therein is not going to be the field day for public power that some may have thought it might be.

As the law now reads, the Interior Department stands to acquire most of the surplus capacity which will be added to public systems. Right now there is sufficient agitation for changes in the law, to presume that some, if not a considerable, amending of the disposal act will be undertaken before the disposition job really gets started.

One reason why the disposal of the war-born power plants is not going to herald a bright new era for public power is the fact that the capacity which stands to be declared surplus totals only slightly more than 1,100,000 kw., or a little more than two percent of the estimated national capacity at the end of 1944.

No Priority for REA

Despite the broad provisions of the act directing the exchange of surplus property between federal agencies, REA, by its own admission, is not eligible to a priority on the purchase of generating capacity—or other surplus electrical equipment—because it, as a banking agency, cannot use it as could the Interior Department or the Tennessee Valley Authority, which operate power systems. Nor are REA co-ops given any special privileges under the act.

TVA doesn't figure to be much of a competitor for the surplus generating capacity, for according to its own definition of its own territory, the capacity located therein totals only 37,300 kw. This is apt to be insufficient to excite a TVA power engineer, particularly when it is produced by 16 different units in at least half a dozen different stations.

Interior is keeping its own counsel regarding its plans for taking over war surplus power equipment, but the Ickes tradition is one of going after anything that looks promising. There is excellent reason to believe that it was Ickes who prompted the President to make the statement that "I have in mind that such plants (war-born power stations) may be utilized after the war in connection with existing public power systems," back in December, 1943, long before surplus disposal legislation was of any concern.

Municipals

The capacity which might be sought by Interior is indeterminate, depending to a considerable degree upon the intentions of that department to fight private systems for territory. It conceivably could be an important block of capacity for the Southwestern Power Administration or for any other such agency Interior might choose to set up, but it is doubtful that even the Interior Department has any detailed knowledge today of what capacity it will want or exactly what it would do with it.

Existing municipal systems conceivably could do a brisk business in surplus power equipment, for there will be units ranging in size from 50-kw. internal combustion machines to 50,000-kw. steam turbines. And the act provides, in its obscure way, that "political sub-divisions and their instrumentalities" shall have "an opportunity to fulfill, in the public interest, their legitimate needs."

Whatever the interest in this generating equipment shown by public systems, the privately-owned power industry must be content with taking the leavings if it plans to buy generating capacity from the government. The aforementioned Presidential dictum should be convincing in this regard. If it is not, the act itself provides that the transfer of surplus property between federal agencies takes priority over every other type of disposal, it requires agencies seeking equipment to review surplus lists constantly, and even directs the surplus property board to point out opportunities to agencies which prove derelict in this regard.

Co-ops Not Particularly Interested

As long as existing conditions obtain REA co-ops do not appear to be heavy purchasers of surplus generating capacity. Up to the present about 90 percent of all energy sold by co-ops is purchased from non-co-op generating sources. Reliable sources say that REA has no intention of breaking this general pattern merely because there will become available a number of surplus generating units of the size which might prove interesting to co-ops. If this surplus equipment is to be disposed of for a song and it becomes apparent that co-ops could generate their own power at appreciable savings, then REA will change its procedure and co-op generating will be encouraged, these sources say. But no such change is to be anticipated unless the savings from self-generation are "appreciable." The chances that equipment will be "given away" at price low enough to allow "appreciable" savings through self-generation are relatively slim as long as any subsidiary of the Reconstruction Finance Corporation is charged with the disposal of this equipment.

One for the Seers

What the situation will be with respect to other electrical equipment is really one for the seers. It has been estimated that there will be as much as $1,000,000,000 worth of electrical equipment declared surplus. How much of it will consist of spliced wire, badly weathered poles or special-purpose equipment, how much of it will be left in foreign lands and how much of it will be sought by the armed services as a strategic reserve is known now to no man.

NEWS OF THE WEEK

Electric Utilities Improve Financial Status Since '37

Federal Power Commission Releases Six-Year Report Showing Sales Up 75 Percent with Only 7 Percent Increase in Plant Investment—Depreciation Reserves Increase 70 Percent—Long-Term Debt Drops

The improvement in financial position of privately owned electric utilities since 1937 is revealed in "The Financial Record of the Electrical Utility Industry, 1937–1943" just released by the Federal Power Commission.

The record is a part of the annually published report, "Statistics of Electric Utilities in the United States" which presents detailed financial and operating information on all large privately-owned electric utilities in the United States. These utilities are defined as those having electric revenues in excess of $250,000 a year and include over 98 percent of all privately-owned electric utilities.

The report shows:

1. Kilowatt-hour sales increased 75 percent, generating capacity 22 percent, number of customers 15 percent and electric revenues 38 percent.

2. The very large increases, indicated by the foregoing figures, were accompanied by an increase of only 7 percent in plant investment. Net plant investment, after deducting reserves for depreciation, actually decreased during the period. The average investment in plant per dollar of revenue, which was $5.47 in 1937, was $4.28 in 1943. Similarly, net investment was $4.38 per dollar of revenue in 1937, and $3.55 in 1943.

3. Some four hundred million dollars of inflation were eliminated from the utility plant accounts. Orders of the Federal Power Commission alone authorized or required the disposition of amounts in excess of original cost aggregating more than three hundred million dollars.

4. Depreciation reserves have been increased by more than one billion dollars or slightly in excess of 70 percent.

5. In spite of increased operating expenses and taxes, net earnings available for investors have been maintained at a remarkably constant level. The ratio of gross income to capitalization and surplus was the same in 1937 and 1943, 5.8 percent. The average ratio for the entire period was also 5.8 percent.

6. Outstanding indebtedness has decreased and the ratio of long term debt to gross investment in utility plant has fallen from 60 to approximately 44 percent. Value of long term debt to net plant decreased from 55 to 54 percent.

7. Interest charges which were covered 2.97 times in 1937 were covered 3.36 times in 1943.

8. Published yield averages based on market prices of selected public utility bonds were reduced from 4.03 percent in 1937 to 2.99 in 1943.

9. More than two billion five hundred million dollars, representing accruals for depreciation and amortization, together with the balance of earnings after payment of dividends, were invested in property additions and replacements or utilized to retire outstanding securities.

10. Facilities were greatly expanded without necessity for the issuance of additional securities to finance construction. In fact the book amount of outstanding stocks and long term debt decreased by some three hundred million dollars.

Discussing the financial progress of the industry in greater detail, the report points out that utility plant accounts, as recorded on the books of the companies, aggregate $14,843,648,475 as of December 31, 1943. At the close of 1937 the corresponding figure was $13,851,583,019. This increase in the six-year period of only about 7 percent reflects, among other influences, the elimination of a large amount of inflation from utility plant accounts resulting primarily from past "write-ups". Dispositions of amounts in excess of original cost approved or directed by the Federal Power Commission aggregated $372,287,972.12 as of December 31, 1943. As of September 15, 1944, such dispositions aggregated $553,109,714.59, the report shows.

In contrast to the one billion dollar increase in the amount recorded on the books of the companies, which is net after retirements and elimination of such inflation as has been written off, reports to the Commission indicate that property additions during the period aggregated about two billion five hundred million dollars.

Depreciation Reserves Rise

Noting that the systems of accounts adopted in 1936, as well as making provisions for elimination of inflation, were the first to give national recognition and effect to the principle of depreciation accounting in the electric utility field, the report states that the reserve for depreciation of utility plant increased from $1,495,249,546 at the close of 1937 to $2,557,240,672 at the close of 1943, an increase of more than 70 percent. "Largely as a result of the extraordinary increase in this reserve, net utility plant after deduction of depreciation as recorded on the books of the companies, was actually slightly less at the end of 1943 than it was six years earlier," the report states.

"The small increase in gross plant and the decrease in the amount of net plant is the more remarkable," the report continues, "when it is considered that during the same six-year period the installed generating capacity of the privately owned electric utilities increased by 22 percent and the number

of customers by 15 percent. During the same period kilowatt-hour sales of electric energy to ultimate consumers increased by 75 percent and electric revenues by 38 percent."

"An important development in utility finance is revealed," the report states, "by comparison of the increase of approximately one billion dollars in plant investment during the six-year period with the actual decrease of about a third of a billion dollars in the amount of securities outstanding on the books of the utilities. It is thus indicated that by and large during the past several years the electric utilities industry has been in a position to finance all extensions to facilities out of revenues and that it has been unnecessary for the industry as a whole to secure additional funds from outside sources."

Total utility operating income, representing the amount available for return on investment in plant for 1937 was $768,964,693 as compared to $759,359,994 in 1943, the amount of the latter year being one percent less than that of the former. Thus after the large increases in depreciation accruals and an increase of more than 100 percent in total tax charges, the balance of income from utility operations available for investors remained in 1943 very nearly equal to that of 1937. This stability has unquestionably been a factor in the general lowering in the cost of capital to the industry which took place during the period, the report states. Published average yields on public utility bonds, from which type of security almost half of the funds invested in the industry are obtained, show a reduction of approximately 26 percent between December 1937 and December 1943, the report adds.

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Utah Power Seeks to Buy Facilities of Utah Light

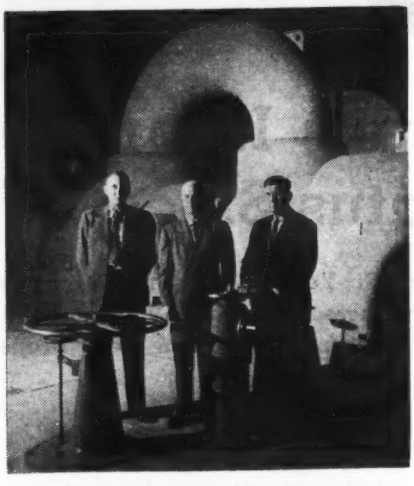
To acquire electric generation and transmission facilities of Utah Light & Traction Co., its wholly owned subsidiary, Utah Power & Light Co. recently filed application with the Utah Public Service Commission.

Acquisition of all non-transportation properties would facilitate the proposed refinancing of U. P. & L. and follow a suggestion of the Securities and Exchange Commission. Transportation equipment of U. L. & T. was acquired recently by Salt Lake City Lines.

The subsidiary's electrical facilities now are used by U. P. & L. under a 99-year lease as part of its system. Outright ownership would simplify corporate structures and result in considerable savings, the application says.

Hawaiian Electric Co. Adds Large Generator

Hawaiian Electric Co. is self-sufficient in generating capacity for the first time since before Pearl Harbor with the completion last month of a 35,000-kw. generator. With demands increasing since the war, the company has been getting assistance from the excess generating capacity of the army and navy



AT GENERATOR INSTALLATION—Emil Olson, left, superintendent of production of the Hawaiian Electric Co. with President Leslie A. Hicks, and L. A. Buese, chief design engineer, pose at new unit after it has been placed in operation

and from the power plants of the Oahu plantations.

The new unit costing over $4,000,000 was cut into the line 45 months after it was ordered in December, 1940. Another unit of similar size will be installed at the Waiau station in 1947.

Manufactured by Westinghouse Electric & Manufacturing Co., the new unit is operated from a single boiler producing a maximum of 390,000 pounds of steam an hour at 700 pounds and a temperature of 905 degrees at the outlet. Initial test runs produced 550 kw.-hr. per barrel of oil used.

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Energizes 2nd 230-kv. Line

Delivering more than 150,000 kw. to the Puget Sound area in the Pacific Northwest, the Bonneville Power Administration's second 230,000-volt Grand Coulee-Covington transmission line was put in operation October 6, 24 days ahead of the energization date originally set by Administration engineers.

The 183-mile line, which was begun June, 1943, and is the first in the Federal grid system to utilize wood pole towers, increases power deliveries to the area to about 350,000 kw. Largest user of this power is the Puget Sound Power & Light Co., which takes in excess of 100,000 kw. to help meet its own loads and to save critical supplies of fuel, oil, Bonneville engineers said.

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E.E.I. Acts to Speed Service after Storms

To speed up the restoration of service in the future in case of hurricanes, storms, and disasters, Edison Electric Institute has three committees at work studying the problems brought by the hurricane of September 14.

The committees, transmission and distribution, engineering and planning, and post-war planning, will attempt to improve construction practices, to establish regional pools of manpower and equipment, and to arrange with State highway departments for a coordinated approach to the problem of removing debris which has demolished power facilities.

Utility engineers have declared that much of the difficulty in restoring service during the hurricane and immediately after was caused by the abnormal manpower shortage and the curtailment under orders of the War Production Board of reserve equipment and materials.

At one time during the hurricane there were 1,750,000 customers without electricity. In most cases, service was interrupted but a few hours, in others over two weeks. Street lighting was out in some sections of Long Island for over three weeks.

At the height of the storm, the following companies showed these percentages of customers without power: Atlantic City Electric Co., 40; Long Island Lighting Co., 90; Queens Borough Gas & Electric Co., 100; New England Gas & Electric Association, 99; Staten Island Edison Corp., 74; Westchester Lighting Co., 50; Public Service Corp. of New Jersey, 30; Boston Edison Co., 50; Connecticut Light & Power Co., 82; Connecticut Power Co., 100; Jersey Central Power & Light Co., 45; New Jersey Power & Light Co., 28; Hartford Electric Light Co., 40; and Virginia Electric & Power Co. 10.

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Utility Sells Gas Lines

South Carolina Electric & Gas Co. has sold its Florence-Darlington gas system to the assigns of Marion D. Lucas of Florence. Mr. Lucas holds an interest in gas plants in both Anderson and Sumter. The state Public Service Commission has approved the sale, and the price is reported to have been approximately $100,000.

P.E.A. Speakers Study Oil Refining and Inhibitors

Substation Safety, Carrier Simplification, Trends of Plastics, and Electric Heat Are Other Topics on Program of Electrical Equipment Committee of Pennsylvania Association—Filtering Procedures Explained

Moderate refining and resort to inhibitors in transformer oil were advocated at a meeting of the Pennsylvania Electric Association Electric Equipment Committee, October 19 and 20, at Johnstown.

"When is a transformer in bad enough condition to warrant removal?" was the theme of a paper by E. R. Whitehead, based on extensive Duquesne Light Co. tests. Conclusion was that any transformer of 20 kv. or above should be replaced and overhauled when the solid-insulation dissipation factor rises above 12 percent (22 percent for 5-kv. class). Engineering attention has to be focussed on about 3 percent of the transformers in carrying out this program. This factor, along with insulation resistance and capacitance, responds consistently to moisture added experimentally. The speaker doubted the efficacy of making refined calculations of load-aging.

Inhibitors in oil was the major topic of one of the four sessions. Stanley O'Dette, of Standard Oil of New Jersey, outlined the evolution of the inhibiting practice and urged careful selection of filtering and re-refining procedures, advocating the purely mechanical types as less likely to over-refine and thus remove the natural or added inhibitors; petroleum is a more sensitive material, he said, than most people seem to realize.

L. J. Berberich, Westinghouse Electric & Manufacturing Co., presented a documented argument in favor of moderate refining so as to retain the advantageous fractions of aromatics which embrace the natural inhibitors of oxidation and corrosion. Oil, he too said, is highly complex and even more so is the art of inhibition. He finds it difficult to make a good case for use of an inhibitor in properly refined transformer oil; complete sealing of equipment practically obviates the necessity of an inhibitor.

Summary of insulation testing practice of several member companies was presented by R. J. Salsbury.

A joint committee report on the deficiencies of prevailing carrier tubes, terminals and associated relays and auxiliaries was approved and now awaits approval by the communications committee. It advocates simplification, ready removability of parts, defined service-life of tubes, reduction in number of tube types, development of a remaining-life test, increase of tube output capacity and limited frequency coverage.

Discussion of safety engineering in station design by R. E. Neidig, Metropolitan Edison Co., brought from D. R. Pattison, Pennsylvania Electric Co., the report that use of aluminum shapes for a new substation structure facilitated the achievement of really safe clearances.

In a preliminary report on safety grounding, E. L. Schlottere outlined Philadelphia Electric Co. practice. It evoked from H. P. Sleeper a dissent in philosophy, his company's, Public Service Electric & Gas Co., practice being to favor isolation and the reliance on detection of voltage. Accidents occur, he said, in the very act of applying and removing safety grounds because it often necessitates exposure beyond that required for the actual work.

Demonstrating the versatility of plastics, A. A. Bates, Westinghouse, refuted the general belief that they cannot approach the strength and toughness of metals, cannot be hard-worked for increased tensile strength and cannot be rendered comparatively independent of temperature. Silicones, he pointed out, are a promising example of the latter objective. He prophesied the electrical industry will hear more and more about nylons for insulation.

Wartime acceleration of the various forms of electric heating led G. E. Stoltz, Westinghouse to forecast the following prospective national load increments in kilowatts per year: resistance furnaces, 100,000; induction furnaces, 5,000; midget heaters, 150,000; induction heating (to 200,000 cycles), 50,000; dielectric heating, 100,000.

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Vote Franchise Extensions

Sioux City Gas & Electric Co. recently was given an extension of 15 years on its gas and electric franchises by a 14 to 1 vote of Sioux City voters.

BOSTON EDISON CO. GHQ DURING HURRICANE—Badly hit by the 1938 hurricane when 292,000 customers were without service and restoration of normal service took two weeks, Boston Edison Co. set up a permanent organization to handle all future emergencies according to plans developed from experiences in 1938. Effectiveness of the organization was tested when the hurricane of September 14 struck. About 184,000 customers were without service which was back to normal in three days. Standing, left to right, R. E. Dillon, vice-president and chief engineer; James V. Toner, president; John T. Ward, vice-president and director of steam and electric operation; Leavitt L. Edgar, vice-president in charge of purchasing. Seated, left to right, Thomas H. Carens, vice-president in charge of public relations; E. J. Hyland, treasurer; Thomas H. Haines, assistant vice-president in charge of transmission and distribution; A. C. Havlin, assistant treasurer; A. J. McEachern, industrial relations manager; D. E. Washburn, power sales manager; C. A. Corney, assistant vice-president in charge of engineering and technical research; H. W. H. Wellington, superintendent of production. At 1 a.m., September 15, when the picture was taken, a number of other members of the organization were out in the field

Arkansas Co-ops Fight Utility for Rural Lines

REA Officials Spur Cooperatives to Oppose Business-Managed Company at Extension Hearings

In an unprecedented battle for rural territory, representatives of Arkansas Power & Light Co. and of 17 rural cooperatives spurred on by Rural Electrification Administration officials argued bitterly day by day last week before the Arkansas Department of Public Utilities. The company has plans to extend rural service in 35 counties of the state and has made applications for extensions in 16 counties. It was the hearings on some of these applications that brought the struggle into the open.

In an effort to forestall the company, REA rushed six key men headed by William J. Neal, deputy REA commissioner and acting administrator at its St. Louis headquarters, to Little Rock where they called a hurried meeting of cooperative leaders and reached an agreement with the Arkansas State Electric Cooperative Corp. for an REA loan of $18,500,000 to service about 55,150 farms after the war.

"The Arkansas Utilities Commission has retarded rural electrification," Mr. Neal said in asking leaders of state cooperatives to agree to an immediate "area coverage" survey for extending their lines to every farm in the state. "Only four other states have a poorer record than Arkansas in rural electrification. Only 16.8 percent of the farms in this state are electrified, although REA made its largest loan in its existence to the A. P. & L."

President Moses Testifies

Striking back, President C. Hamilton Moses of the utility company said on the witness stand at a hearing on the following day: "The government's willingness to socialize our industries and take over our business has influenced A. P. & L. to extend its rural development program in some sections below the 'good business line' in order to eliminate the outstanding threat to our peace and life."

Indicative of the position of A. P. & L. is the new schedule of rates for cooperatives (ELECTRICAL WORLD, October 21, p. 10) which would give them the lowest rates in the nation.

The utility president also declared that his company had no trouble in getting along with cooperatives in the state if government bureaus would let us alone. He pointed out that the company had pioneered in rural electrification and said that in its early days when the farmers could not pay in cash, company men took hams, chickens, eggs, butter and other products and sold them on the market to pay for the lines.

Frank Wills, Little Rock attorney representing the First Electric Cooperative Association and other co-ops at the utilities hearing, verified Mr. Moses' statement and said as a matter of record, "The First Electric Cooperative and the A. P. & L. always have been able to get together."

Hearings will continue on the applications, and the utilities commission has asked that applications be slowed until "surveys are completed."

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Lamp Bulb Production Rises in Second Quarter

Production of electric lamps and bulbs for illumination purposes in the second quarter of 1944 totalled $38,572,000, an increase of 3.8 percent over the $37,268,000 volume in the preceding quarter and 21.1 percent over the $31,846,000 total for the second quarter of 1943, the War Production Board has reported.

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City Buys Transformers

By buying four used small transformers for $13,000, North Little Rock, Ark. will have sufficient facilities for the next 20 years, city officials believe. The municipality has been renting a large transformer from the Arkansas Power & Light Co. at a cost of approximately $6,000 a year.

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WPB Cancels Order L-212

WPB has revoked Order L-212, controlling the manufacture and distribution of incandescent lighting fixtures, but only a small production increase will result because output will still be limited by allotments of controlled materials and by availability of labor, shipping cartons and components.

It was emphasized that the revocation of L-212 does not mean that non-industrial types of portable electric lamps are freed of restrictions since these types are controlled by Order L-33.

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Will Sell Gas Facilities

Contract has been signed with James A. Pierce of Hartford, Conn., for the sale of all gas properties owned by the Public Service Co. of New Hampshire, Avery R. Schiller, president, has announced. The properties serve 10,500 customers in Nashua, Keene, Laconia and Dover.

Labor Joins Attack on P.U.D. Measure

Public utility districts in Washington have spent $824,357 for fees of various kinds out of the $2,000,000 which they have collected in taxes, two union leaders who are leading labor opposition to Referendum 25 (ELECTRICAL WORLD, October 14, p. 109), charged recently.

Ernest R. Hanstead and Ernest J. Brazas, group presidents of Local 77 of the International Brotherhood of Electrical Workers, listed the fees as including: attorneys $368,328; engineers, $379,885; negotiating committee, $35,208; and research and information service, $339,933. They said that $432,801 was paid by operating districts while $391,556 was paid by districts which are established but operate no power facilities.

Labor has joined the business-managed and municipal utility companies and many business organizations in fighting the referendum (which will be voted on November 7) which would allow public utility districts to merge and take over business-managed utilities and municipally operated companies as well.

Legal Fees Cited

Labor leaders say that if the measure passes and business-managed companies are taken over, 4,000 union men will lose their collective bargaining rights under the National Labor Relations Act, overtime compensation rights, certain Social Security benefits, pension rights, and the right to unemployment insurance.

Hanstead and Brazas named two Seattle attorneys, Jack R. Cluck and Paul Coughlin, as having been listed in the Congressional Record as helping to draft the referendum, and added that their law firm, Houghton, Cluck & Coughlin, has received more than $140,000 in legal fees.

They said that Clarence Coleman of Everett, an attorney and Democratic national committeeman for Washington, represents the Snohomish County Utility District and has received $12,600 in legal fees. E. K. Murray, Tacoma attorney, was listed as having received in excess of $79,000 in legal fees for his services. They said that Herman Lafky, a Salem, Ore., attorney, had received nearly $40,000 in legal fees from utility districts located in the State of Washington.

In discussing the $379,885 spent for engineering fees, the labor leaders said, "$166,000 of this was paid out by utility districts which have never operated any electric property whatsoever."

Tropical Storm Hits Southeastern Coast

Damage to Power Facilities Is Light—Fallen Trees Troublesome —Manpower Shortage a Problem

A tropical storm struck the coast of Florida early on the morning of October 19 and swept north across the coastal portions of Georgia and South Carolina causing some damage to power facilities but not approaching that done by the recent hurricane in the Northeastern states.

Most of the damage was caused by winds snapping poles and trees and in this way bringing down lines. Underground conduits again proved their value in the business districts. Heavy rainfall accompanying the storm did relatively little damage to power lines and equipment. However, it did hinder repair work and kept power officials apprehensive of flood dangers. Service was speedily restored in most sections, and manpower shortage was felt in most areas.

Charleston, S. C., served by the South Carolina Power Co. was hard hit. Practically the entire city was in darkness, and two newspapers were forced to skip editions.

In Florida, Tampa Electric Co. reported most damage as being caused by fallen trees. Interruptions in service reached 75 percent, but most of these were of short duration. Some time, however, will be required to erase all damage done.

Jacksonville, Fla., on the east coast, served by its own municipal plant, was harder hit as it was nearer the storm center. Of 55,000 customers, about 40,000 were without power at the peak of the storm. Broken poles and trees caused most of the trouble. In the section served by 13-kv. underground lines, there were no interruptions. By Friday evening 80 percent of the service was restored.

Of material assistance in the emergency was the mobile railroad power unit recently loaned to the city by the Navy. The unit was in continuous operation during the storm.

Interruptions to war industries were slight and caused no great damage or inconvenience.

Local independent two-way short-wave radio communications of the company speeded the restoration of service. Members of the Water Department of the city which with the Light Department is under one head greatly aided in restoring service.

Florida Power Corp. reported temporary difficulties in every town on its system from Avon Park in the south to DeLand in the north. In St. Petersburg, the Bayboro plant was out of operation for five hours because short circuits on a 11,000-kv. line caused a main switch and an auxiliary one to blow up. These accidents cut off the power to the underground system in the city.

Practically all feeder lines throughout two-thirds of the system were down as were many primary and secondary wires. By Sunday night, nearly all lines were back in service.

Sunday night, D. T. Haddon, one of the six linemen of the Georgia Power Co. flown to St. Petersburg from Atlanta, was electrocuted by 4-kw. line at Snell Isle, exclusive residential section of St. Petersburg.

Georgia Power & Light Co. reported its Valdosta area slightly affected with only 300 customers off 36 hours. In the Waycross area, 5,700 customers were off at the peak of which half were reconnected within 24 hours and practically all others in 72 hours. The company was also able to send two crews into an associated company territory in the Deland, Florida, area.

Georgia Power Co. reported that its Arco stream generating plant at Brunswick was flooded by a three to four foot flood tide. In that city and vicinity 6,000 customers were without service at peak of the storm. In Vidalia and Tifton areas in South Georgia and in Augusta in East Georgia, there were 6,850 customers out, in most cases for short periods.

Unlike most of the companies affected, Georgia Power had enough manpower to handle its own difficulties and was able in addition to send crews to Charleston, S. C., Savannah, Ga., Orlando, Fernandina, Winter Park, Daytona Beach, and St. Petersburg, Fla.

Savannah Electric & Power Co. reported "tree" trouble. Main feeders had little interruptions, and at peak no more than 20 percent of the customers were out. One residential section of some 40 blocks was out from 1 to 11:30 p. m., Thursday. Outlying districts, including some islands, off the coast were back by Saturday, and with few exceptions all service had been restored by Sunday night.

TROUBLE BLOWS INTO THE SOUTH—Reminiscent of recently published pictures of the hurricane of September 14 which struck the Northeastern states is this scene from Jacksonville, Fla. where considerable damage was done to the lines of Jacksonville Electric Department by the storm of October 19.

FPC Admits Case Is Out of Jurisdiction

Upon determining that the sale of energy by the Connecticut Power Co. to the Torrington Electric Light Co. is an "intrastate" sale of energy and therefore that the rates involved are not subject to its jurisdiction, the Federal Power Commission has vacated an order suspending a rate schedule filed by the former, covering sales to Torrington which involves an estimated annual rate increase of about $104,000 yearly.

The decision to vacate its order followed an investigation of the situation by FPC's field staff and a conference by FPC with members of the Connecticut Public Utilities Commission. FPC gave no reason for its action.

The rate increase to Torrington was predicated principally upon an increase in the cost of energy purchased by Connecticut Power from the Hartford Electric Light Co. for resale to Torrington. The increase in production cost was due to increases in the cost of fuel. Torrington agreed to the increase, which had been validated by the Connecticut commission before FPC's suspension order was issued.

Utah Supreme Court Backs Cut in Rates

The Utah state supreme court handed down a unanimous decision recently affirming an order of the state public service commission directing a 12 percent reduction in electric power rates charged by the Utah Power & Light Co. to its Utah customers.

The reduced rates now prescribed will curtail sales volume by $1,504,644 based on the 1941 volume of business, it is calculated.

Under the commission order now upheld, the company must pay rebates to its consumers amounting to an estimated $1,500,000, representing the difference between rates now charged and reduced rates ordered effective October 15, 1943.

The decision ends two years of hearings between the commission and U. P. & L. concerning rate reductions. The case had been under consideration in the supreme court since March.

Prescribed rate reductions will not become effective until after the statutory 20-day period to petition for rehearing. Since the appeal was taken to the high court, the company has been placing in a Salt Lake bank an amount equal to the difference between the old and the new rates. This is to be distributed among rate payers after the order becomes final.

Principal bone of contention was the allegation by the commission that the power company has been earning more than a reasonable return on a just and proper rate base.

The court ruling departs from the old theory of fair present value of properties as a rate base as upheld by the U. S. Supreme Court case. Smyth vs. Ames, and adopts a 1944 theory of the same court embodied in the Federal Power Commission vs. Hope Natural Gas Co., to the effect that the amount prudently invested should be the rate base.

Declaring the commission "has included in the prudent investment base all of the investments which should have been properly included and has allowed a reasonable rate of return thereon, 6 percent," the court pointed out that "future anticipated reductions in fixed charges over those payable in 1941 present a picture not unfavorable to preferred stockholders."

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Eases Spraying Oil Rules

Any grade of fuel oil may be used to spray coal piles, the Petroleum Administration for War announced this week after amending Petroleum Distribution Order 13. Heretofore, only Nos. 5 and 6 and Bunker C fuel oil, asphalt and asphaltic products could be used to spray coal piles. The amendment was issued upon recommendation of the Solid Fuels Administration for War since many coal stockpilers are not equipped to spray coal with heavy oils.

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Will Vote on City Plant

City Council, Clarinda, Iowa, has called a special election November 1 to approve a bond issue of $550,000 for establishment of a proposed municipal light and power plant.

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U. S. Government Appeals P.E.P. Co. Rate Decision

A second appeal from an order by the District of Columbia Public Utilities Commission cutting rates of the Potomac Electric Power Co. by $1,037,000 anually and making other changes in the sliding scale agreement has been taken to the District Court of Appeals by the Federal government, which held that the order set rates "unjustly and unreasonably high."

P.E.P. Co. had appealed the order as setting rates too low.

The Federal appeal held that the government is the company's largest customer, paying $6,000,000 annually for service, or "approximately one-fourth of P.E.P. Co.'s gross income."

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Arizona Would Use Extra Profits to Reduce Rates

Ordering all Arizona utilities to show cause why their excess profits should not be returned to consumers in the form of rate reductions, the Arizona Corp. Commission in mid-October launched an inquiry paralleling current studies by the California Railroad Commission (ELECTRICAL WORLD, October 7, p. 9) into excess profits taxes and utility rates.

All electric, gas and water utilities in the state were instructed by the Commission to estimate their earnings for the period ending September 30, 1944, and to report them by October 28.

A show cause hearing will be held November 6 to inquire why utility rates should not be reduced during November and December to "eliminate excess profits income taxes", it was reported. Utilities also will be asked why they should not appropriately distribute resultant reductions among their consumers.

Louisville Sues Kentucky to Change Utility Levy

Louisville, Ky., has filed suit in the Franklin Circuit Court to require the State Tax Commission to set aside its tax assessment against the Louisville Gas & Electric Co.

The city charges the commission's certification was void because it "adopted fundamentally erroneous methods of valuation and assessment" and "unlawfully sought to exempt from taxation by the city, property it was entitled to tax." Tax revenue of about $150,000 is involved.

Chief objection was the listing by the state of certain property as "manufacturing machinery" which the state may tax and the city may not.

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MEETINGS

Technical Valuation Society—Annual forum and business meeting, Building Trades Club, 2 Park Ave., New York, N. Y., December 16. W. C. Fisher, chairman, Room 516, 4 Irving Place, New York, N. Y.

Previously Listed

Joint Fuels Conference—American Institute of Mining Engineers and American Society of Mechanical Engineers—Daniel Boone Hotel, Charleston, W. Va., October 30-31. A. B. Parsons, secretary, American Institute of Mining Engineers, 29 W. 39th St., New York 18, N. Y.

Petroleum Electric Power Association — Annual meeting, Dallas, Tex., November 2. L. B. Blalock, vice-president, c/o Texas Power & Light Co., Dallas, Tex.

Pacific Coast Electrical Association—Annual fall conferences, northern section, Fairmont Hotel, San Francisco, Calif., November 9; southern section, Hollywood Roosevelt Hotel, Hollywood, Calif., November 16. V. W. Hartley, managing director, 601 W. 5th St., Los Angeles, Calif.

Southeastern Electric Exchange—Sales conference, Henry Grady Hotel, Atlanta, Ga., November 9-10. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 3, Ga.

National Association of Railroad and Utilities Commissioners—Annual meeting, Hotel Fontenelle, Omaha, Neb., November 14-17. Ben Smart, secretary, 7411 New Post Office Bldg., Washington 25, D. C.

Pennsylvania Electric Association—Communications committee, Roosevelt Hotel, Pittsburgh, Pa., November 16-17. J. G. McKinley, chairman, West Penn Power Co., Pittsburgh, Pa.

Great Lakes Power Club—Fall meeting, Palmer House, Chicago, Ill., November 17. A. Stretting, secretary, Wisconsin Electric Power Co., Milwaukee, Wis.

American Society of Mechanical Engineers—Annual meeting, Hotel Pennsylvania, New York, N. Y., November 27-30. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

National Exposition of Power and Mechanical Engineering — Madison Square Garden, New York, N. Y., November 27-December 2.

National Association of Manufacturers—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., December 6-8. J. M. Boyd, secretary, 14 W. 49th St., New York 19, N. Y.

American Standards Association — Annual meeting, Hotel Roosevelt, New York, N. Y., December 8. P. G. Agnew, secretary, 70 E. 45th St., New York 17, N. Y.

Electric Output Curve Again Loses Ground

The output curve, for the second consecutive week, moved downward during the week ended October 21, 1944, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week amounted to 4,345,352,000 kw.-hr., as compared with 4,354,575,000 kw.-hr. for the preceding week ended October 14. Figures for the week represented a decrease of 1.6 percent under the 4,415,405,000 kw.-hr. distributed during the corresponding week a year ago.

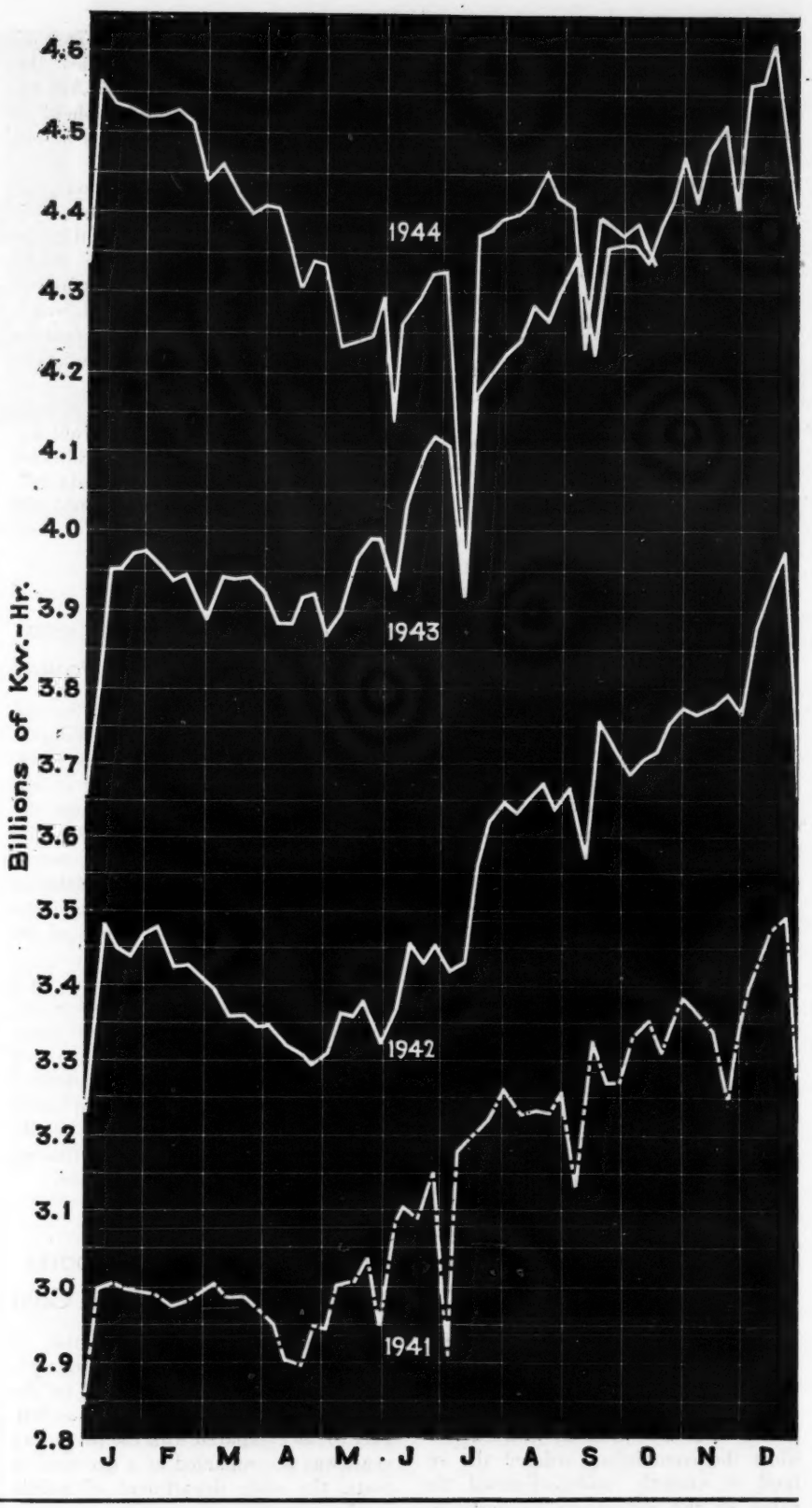
Only three, instead of the customary four, of the seven major geographic regions of the country reported increases over the corresponding week in 1943, the Central Industrial group entering the minus column. Gains, reported by the West Central states and the Southern states during the week ended October 14 as compared with the corresponding week of 1943, were cut down somewhat during the week ended October 21, but losses shown by the Rocky Mountain and Pacific Coast groups during the week ended October 14 were also reduced during the week ended October 21, 1944.

Weekly Output Millions Kw.-Hr.

1944		1943		1942	
Oct. 21	4,345	Oct. 23	4,415	Oct. 24	3,753
Oct. 14	4,355	Oct. 16	4,382	Oct. 17	3,717
Oct. 7	4,375	Oct. 9	4,342	Oct. 10	3,702
Sept. 30	4,366	Oct. 2	4,359	Oct. 3	3,683
Sept. 23	4,377	Sept. 25	4,360	Sept. 26	3,720
Sept. 16	4,395	Sept. 18	4,359	Sept. 19	3,757
Sept. 9	4,228	Sept. 11	4,227	Sept. 12	3,583
Sept. 2	4,415	Sept. 4	4,351	Sept. 5	3,673
Aug. 26	4,418	Aug. 28	4,322	Aug. 29	3,640
Aug. 19	4,451	Aug. 21	4,265	Aug. 22	3,674
Aug. 12	4,415	Aug. 14	4,288	Aug. 15	3,655
Aug. 5	4,399	Aug. 7	4,241	Aug. 8	3,637

Percent Change from Previous Year

	Week Ending		
	Oct. 21	Oct. 14	Oct. 7
New England	+ 0.1	+ 1.0	+ 0.5
Mid Atlantic	— 5.6	— 5.0	— 3.4
Central Industrial	— 0.5	+ 1.6	+ 2.8
West Central	+ 3.4	+ 5.4	+ 7.9
Southern States	+ 2.6	+ 3.5	+ 5.7
Rocky Mountain	—11.8	—12.6	—10.3
Pacific Coast	— 0.5	— 2.0	— 4.2
Total United States	— 1.6	— 0.6	+ 0.8



Utah Group Will Study Colorado River Projects

A study of projects of the lower Colorado River in light of the proposed treaty with Mexico will be made by a committee of three Utahans named as the Utah Water Users' Association completed permanent organization recently.

Inquiries into the reasons for California's vigorous opposition to the treaty and studies of projects in Arizona, California and Mexico were suggested by William R. Wallace of Salt Lake City, former chairman of the Utah water storage commission, who was elected president of the association. Wallace Mathis of St. George, Horace Allred of Duchesne and Byron Howard of Huntington, directors from the Colorado basin in Utah, will make the survey.

Under terms of the treaty pending before the Senate foreign relations committee, Mexico would receive 1,500,000 acre feet of Colorado River waters annually.

OPA Analyst Favors Lower Return Rate

Lawrence S. Knappen Testifies at Detroit Edison Co. Hearing—Judge Orders Funds Impounded

The Detroit Edison Co.'s rate of return on capital investment should be lower during war time, according to testimony of Dr. Lawrence S. Knappen, senior rate analyst of the transportation and utility branch of OPA, in the company's rate appeal hearing recently before special Circuit Judge Archie D. McDonald.

The suit was brought by Detroit Edison after the Michigan Public Service Commission had ordered it to refund $10,450,000 to its customers to avoid payment of federal excess profits taxes. An injunction has been granted restraining the commission from enforcing the order pending the outcome of the trial.

Judge McDonald has also signed an order impounding funds, totaling $10,450,000, in three Detroit banks until the case is decided. Fifty percent of all electric revenues of the company will be placed in the banks from October 11 to 30 until the sum is reached. The order was agreed to by the commission, the City of Detroit and other parties interested in the suit. The action was taken, according to counsel for Detroit Edison, to safeguard the company in case the court affirmed the order.

OPA May Intervene

The judge permitted Harry R. Booth, OPA attorney from Washington, to question Dr. Knappen on the witness stand pending the court's decision as to whether or not OPA will be permitted to intervene in the suit.

Knappen declared that if the company were permitted to pass the expense along to the consumers and maintain its peace time rate of return, it would not be paying its share of the war costs, and added that the commission's rate reduction order would not appreciably affect the value of Edison's securities.

Charles R. Landrigan, assistant controller of Detroit Edison, testified that when the commission ordered the refund it unjustly underestimated the value of the company's property by $121,646,851. He pointed out that last August the commission fixed the value of the property at only $283,315,322, while estimates had set the value in 1943 at $404,963,173.

Landrigan also testified that the commission failed to consider a disputed 20-percent Detroit city tax levy before issuing its $10,450,000 refund order.

He declared that the city's tax on Edison's gross profits would leave the company with a deficit of $9,551,326 for 1943 and 1944 if the levy is upheld in the Wayne County Circuit Court before which the suit is pending.

In contradicting the commission's figures which reveal the company's estimated net return for 1944 would mean a 4.68 percent return to the stockholders, Landrigan said the actual net earning would be only $5,050,934, which represents a return of 1.78 percent to the stockholders if the city's tax is upheld.

In arriving at the $9,551,326 deficit, Landrigan subtracted the net profit figure from the total of $4,789,587 interest on long-term debts; $7,631,673, six percent dividend on stock; $663,000 pension costs, and $1,518,000 for contingencies.

•

Municipal Utilities Oppose P.S.C. Rate-Making Power

Complaining that the Public Service Commission has ordered some municipal-controlled electric companies to reduce their rates on the ground of excessive returns on their investment, the Municipal Electric Utilities Association of New York State at its recent annual conference called for legislation to prohibit the commission "from instituting electric rate proceedings of its own motion."

A spokesman for the association said that though rates of the members are comparable with, and in most cases lower than, those of business-managed companies, the commission has ordered reductions. This action has been taken even though the consumer is wholly satisfied and even though the returns revert to the benefit of the consumer.

•

Washington State Reports More Power, Less Cost

An increase in the consumption of electricity generated by both privately and publicly owned companies in the state of Washington for the year ended, July 31, as compared with the preceding year, was accompanied by a decrease in costs, the state department of public service reports.

During the year ended, July 31, total sales of power amounted to $64,644,614, representing an increase of 13.81 percent in revenue for 22.62 percent more power. Of these sales, private companies received $34,514,079 for 3,129,038,166 kw.-hr., and publicly-owned companies received $30,130,535 for 7,046,928,227 kw.-hr.

Utility to Furnish Power for Kaiser Steel Plant

Entire power requirements of the Fontana steel plant of the Henry J. Kaiser interests will be furnished by Southern California Edison Co. as the result of a recently negotiated five-year contract embodying rate reductions approved by the California Railroad Commission.

Under terms of the contract it is estimated that the steel plant will pay $550,000 a year for three-phase, 50-cycle energy at 66,000 volts delivered to the mill. With a connected load of 20,100 hp., a usage of 7,500,000 kw.-hr. and with a load factor of 90 percent, the net bill will be lower than would result from the existing schedule.

The contract, retroactive to May 1, 1944, may be cancelled by Kaiser upon 90 days written notice, but only at the expense of $7,500 payment for each month of the unexpired portion of the lease.

•

Alder Dam Completed

In the presence of city officials, Alder Dam, the largest of two structures comprising Tacoma's second Nisqually power project, was completed recently. Alder is about 1,600 feet across the top from bank to bank and rises 330 feet above the former surface of the Nisqually River. More than 420,000 cu.yd. of concrete went into its construction. The Alder power house was designed to accommodate two generators with a capacity of 25,000 kw. each.

•

Mexican Plant Planned

Federal Electricity Commission of Mexico has approved plans for a large power plant in the Laguna district in Mexico' cotton belt. Priority rights on equipment will be sought shortly from the United States government.

UTILITY REPORTS

	Net Income 1944	1943
*California Electric Power and subs	$1,320,382	$1,097,771
†Central Hudson Gas & Elec.	1,241,005	1,517,807
†Central Maine Power	3,213,535	3,385,788
†Detroit Edison and subs.	8,800,766	8,428,635
*Florida Power & Light	2,743,663	2,402,919
*Kansas Gas & Electric	1,237,674	1,655,157
*Mississippi Power & Light	626,651	764,169
*New Orleans Public Service	1,555,531	2,076,759
*Northwestern Electric	521,284	714,459
*Pacific Power & Light	848,063	1,167,134
†Texas Electric Service	1,375,675	2,498,432
*Texas Power & Light	2,594,759	2,721,581

* Twelve months ended August 31.
† Twelve months ended September 30.

HOW

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Dial and Load Tests on One Gang Board

In Canada all electricity meters, before being installed for the purpose of establishing a charge, must be approved as to type by the National Research Council and tested and sealed by an officer of the Electricity and Gas Inspection Service of the Department of Trade and Commerce.

Under the electricity regulations, every meter is submitted to specified tests for accuracy at fifty and one hundred percent power factor. In addition, every meter is subjected to a running test at full load speed of sufficient duration to prove that the test constant, gear ratio and register constant bear the correct relation to each other as shown by kilowatt hours recorded on the dial.

In the smaller test centers where economic considerations limit testing facilities to one board, the tests for accuracy and correct registration are carried out in two separate operations. In larger centres however, such as Montreal, Quebec, where a high percentage of the total number of meters presented for testing are of five and ten ampere capacity, a great deal of the inspection work is carried out on boards especially designed to permit both the accuracy and dial tests to be made simultaneously.

In Montreal, approximately eighty percent of the five thousand meters required to be presented for testing monthly by the Quebec Hydro Electric Commission are low capacity domestic meters and the use of boards, connected as shown in the accompanying schematic diagram, saves much of the time that ordinarily would be consumed in checking the dial.

These test panels are very easily constructed from equipment readily obtainable from any electrical supply house. The base mounted switches, tumbler switch and standard resistor units for loading comprise the bulk material that ordinarily would have to be purchased by any utility.

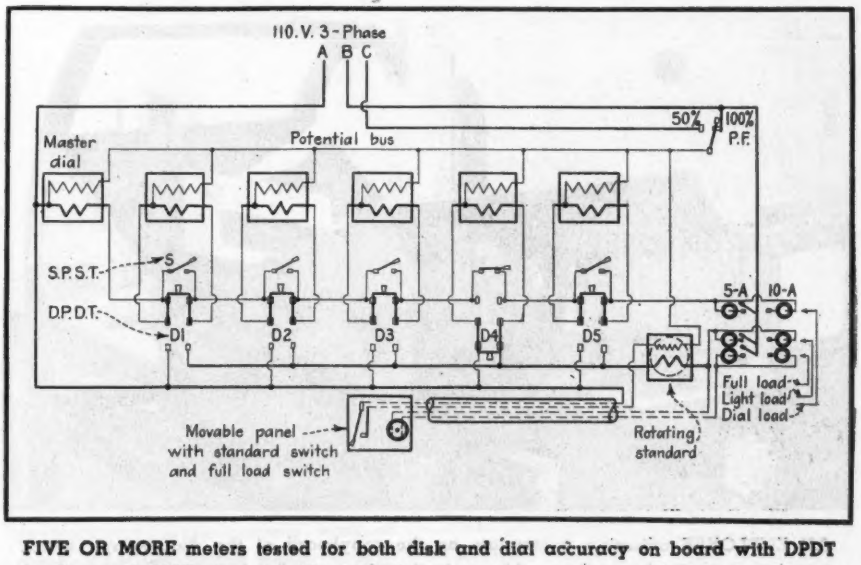
Method of Operation

All meters are first connected to the dial test circuit by throwing the double pole, double throw and the single pole switches into position as shown in D1, D2, D3, and D5. Full load is then applied and all meters run continuously until all tests are completed, with the exception of the short period of time taken to check them individually for disc speed accuracy. The dial registrations are then checked against the dial of the master meter installed at the left of the panel.

When the meters have been operating under dial test for a sufficient length of time to assume normal operating temperature, any individual meter may be tested for accuracy by simply throwing the single and double pole switches into position as shown in D4. A Sliding base, as shown in the drawing, mounting the switch controlling the potential circuit of the rotating standard and a light and full load change switch, has proved a great convenience where longer boards are required to take care of a greater number of meters.

Individual meters may be removed from the circuit without interfering with any of the others by opening the corresponding "D" switch and closing the short-circuiting switch.

Creep tests are made while all the meters are connected in the dial test



FIVE OR MORE meters tested for both disk and dial accuracy on board with DPDT loading and SPST short-circuiting switches

position. Opening any "D" switch will creep-test the preceding meter, except the last meter which is thus tested by means of the dial test load switch.

Panels of this design with their somewhat unusual features have given excellent results over a number of years.

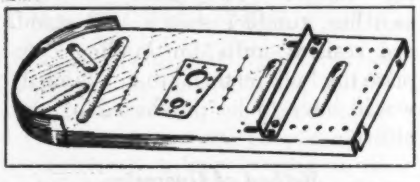
•

Trimetric Drawings Preparation Speeded

Trimetric drawings, a type of three dimensional drawing recognized as the ideal form of production illustration but seldom used because of the difficulties involved in their preparation, are the result of new developments by W. G. Wilkinson and H. C. Bartholomew of the Engineering Department of The Glenn L. Martin Co., Baltimore, Maryland. Such drawings could give a distribution employee as clear a conception of the relative location and interconnections on a pole or in a vault as has been afforded to workers in aircraft assembly plants.

The new machine, known as the Martin Axonograph, is a device for photographically translating a conventional orthographic drawing into a scale representation of one face or dimension of a trimetric projection. The other two dimensions or faces are then filled in by a draftsman to give a scale trimetric drawing in from $\frac{1}{3}$ to $\frac{1}{2}$ the time which would normally be needed. By adjusting the machine and the position of the print on the copy board according to a predetermined scale, it is possible to produce the resulting print in any one of the three trimetric planes—plan, face or side. It is possible to vary the scale as required while maintaining accuracy within four decimal points.

The machine consists of a moving copy board which holds the drawing to be photographed and is adjustable in its angle of slant, an adjustable device for setting the position of the copy of the board, an electric motor to move the board forward and back, a camera for recording the axonometric projection, a funnel which moves vertically and restricts the camera's view to a narrow slot in the end, a 3,000 watt tube to illuminate the negative, a stand which supports the rolling fulcrum of the funnel, and a movable stand which supports the camera. It offers a clearer picture of how the various parts and subassemblies go together than can be given by an orthographic projection or by other types of three dimensional drawings such as perspective, oblique and isometric.

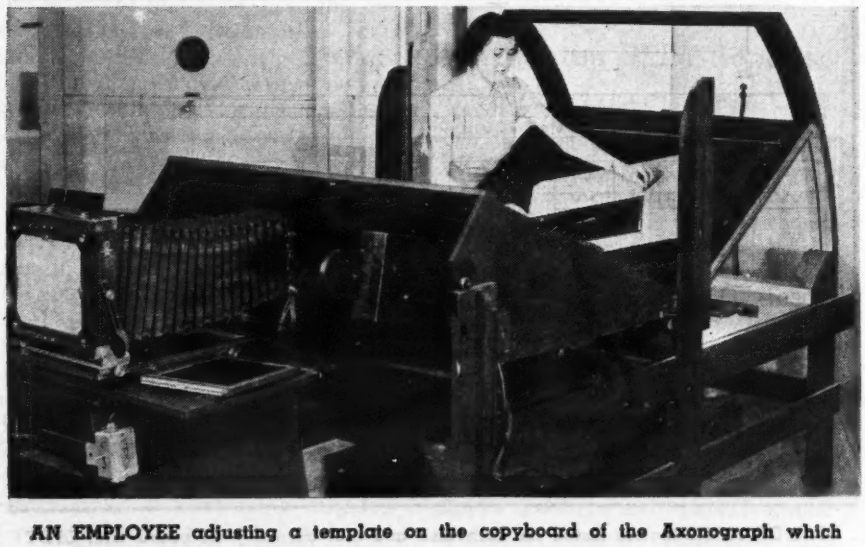


FINISH trimetric print of a complex part traced from the Axonometric print. Dimensions are filled in by hand

The procedure for preparing a trimetric drawing by means of the Axonograph is as follows: 1. Scale desired on the finished drawing is determined. 2. Drawing is broken down into various component parts. 3. Negatives from which the lofting templates of these parts were made are sent to the Axonograph with instructions as to scale and the principal plane in which each part will appear on the finished trimetric.

The former depends on the scale of the finished drawing and the scales of the drawings from which the Axonograph prints are to be made. If all prints are to the same scale, only one setting is required, but if they are to different scales, the machine can be adjusted to compensate for this and produce prints which are all to one scale.

The plane in which the print is to be made is determined by nature of the part and its position in relation to the position of the finished drawing.



AN EMPLOYEE adjusting a template on the copyboard of the Axonograph which transforms a regular orthographic projection into an Axonometric print

•

Simply Protected Motor-Driven Exciters

By J. K. OSTRANDER
United Engineers & Constructors, Inc.
Philadelphia, Pa.

The great majority of turbogenerators installed during recent years have been equipped with shaft-driven exciters and no doubt, in most cases, this course of procedure has been quite proper. However, an investigation of this subject does not lead to the conclusion that the shaft-driven exciter is inherently the best means for providing excitation, particularly for the large hydrogen-cooled generators.

A large turbogenerator may represent an investment of a million dollars and an accidental outage of this machine is a serious matter. Although the shaft-driven exciter has now become quite a reliable piece of equipment, anything of this size which is attached to the main shaft constitutes a potential hazard to operation and requires care and attention. Furthermore, the shaft-driven exciter adds a considerable amount to the length of the main unit. This may necessitate extra building width or sacrifice of aisle space. It is true that in some cases the space occupied by the exciter would be required for the removal of the rotor, but if the exciter were not attached to the main shaft, it would never be located at the end of the main generator. This is not a desirable place for it.

Driving the exciter from the main shaft has some justification which cannot be ignored. The exciter is essentially an integral part of the main

unit and therefore should be closely associated with it physically, unless an equivalent result can be obtained by other means. If the motor-driven exciter be substituted for the shaft-driven exciter, it is generally believed that a sacrifice in reliability is inevitable and that this is not an equivalent means. Whether this is true or not, of course, depends upon the method of driving the separate exciter. It therefore might be interesting to compare the probable reliability of driving the exciter by the main shaft and by electrical equipment.

Generator Leads Tapped

It is now common practice to tap the main generator leads for connecting to capacitors and lightning arresters. To this group of equipment might be added a transformer of sufficient size to operate an induction motor driving the exciter. This motor circuit would be extremely simple. No switching or other equipment would be used in the primary of the transformer. This circuit would have complete protection as it would be within the generator differential limits. The starting current of the motor could be low enough so that it would not trip the differential relay, but any fault in the circuit would trip these relays. The secondary of the transformer with a voltage of probably 440 volts would be equipped with a small air circuit breaker and perhaps nothing else. With such a system the exciter becomes almost as closely associated with the main unit as if it were driven from the main shaft. The parts of the system subject to failure are a small transformer, an induction motor, a low duty air circuit breaker, and a short length of low-voltage cable. It would seem that freedom from failure in this equipment could be practically assured by giving proper attention to the insulation.

The shaft-driven exciter is often considered essential because it is not affected by system voltage disturbances. In this respect the motor exciter is not necessarily deficient. If an oversized motor is used, a considerable drop in voltage may occur before the pull-out point of the motor is reached. Even if it is reached, a considerable time element is involved. If the system voltage should remain extremely low for a long period, perhaps the excitation should be removed from the generator.

When a motor exciter is used, it is necessary to have a spare exciter in order to obtain initial voltage on the generator. This is a disadvantage, but it is generally unimportant in a large station because a spare exciter is almost always available.

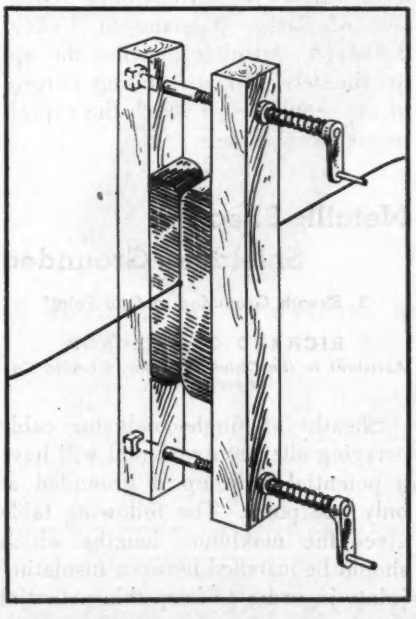
It is now common practice to connect a station auxiliary transformer to the main generator leads. When this is done a separate transformer for the exciter may not be considered necessary. If the design of the auxiliary system is such that the necessary degree of reliability for exciter operation can be obtained by connecting the exciter motor to the auxiliary bus, the use of the separate exciter transformer is not desirable.

This discussion is not intended to constitute a recommendation against the use of shaft-driven exciters, but it is intended to show that the use of the motor exciter may be preferable, depending upon the particular conditions prevailing for a given installation.

•

Wire-Stringing Brake

Constructed of parts readily available to any line crew, the conductor brake illustrated in the accompanying sketch has demonstrated real usefulness in overhead line work in the Roanoke Division of the Appalachian Electric Power Co. It consists of a pair of cross arms with spring tension bolts through the end pin holes. On the facing surfaces of the arms



CONDUCTOR brake reduces work of sagging by maintaining steady drag

are fixed pieces of old tires between which the wire is pulled. By tightening up on the bolts the required drag on the wire for any desired sag can be set and maintained.

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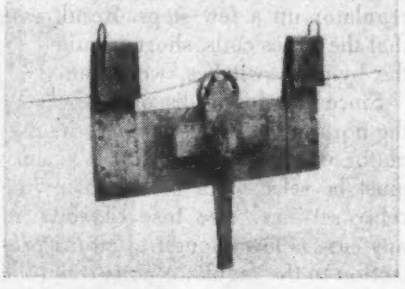
Cement Deposit Remover

For years utilities have wrestled with the problem of removing cement deposit from the line conductors in



INSTRUMENT 36 in. long with body 11 in. high has conductors passing under lips of two six inch sheaves. The two loops at the top are for attaching hand line

the vicinity of cement plants. A solution has been found by W. A. Fox, Pacific Gas & Electric Co.

The device, as illustrated, consists of a metal plate with three sheaves which is pulled back and forth on the conductor. The center sheave is adjustable so that when the lever is pulled to the position shown, three bends are placed in the wire. The tool is then drawn from one pole to another by the winch on a line truck. The action is to crack the cement deposit, which crumbles and falls off.

The sheaves are plain grooved 6-in. sheaves removed from old blocks. These are not burred, the double bend in the wire being sufficient to crack the cement.

Formerly it was necessary to lower conductors to the ground and beat the cement deposit off with paddles or anything suitable for the purpose. Cost of removing cement deposit from the 60-kv. line feeding one of the cement plants on the company's lines has been reduced to one-fourth the former expense.

•

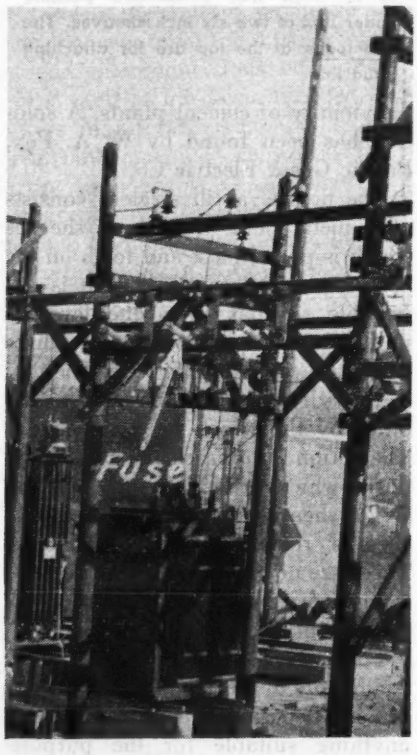
Fused Disconnects Protect Regulator

Fused disconnecting switches are now a part of high-voltage step regulator installations on the system of the East Tennessee Light & Power

Co. The reason therefor resides in a past experience when a regulator burned out some coils after the by-pass disconnecting switches had been closed and before the unit was cut off the line.

Preparatory to taking the regulator out it had been set on neutral and the by-pass switches closed. Then the by-pass was closed before opening the control circuit which, attempting to correct a voltage charge, pushed the regulator up a few steps. Result was that the series coils, short-circuited by the by-pass switches, were damaged.

Since the fused disconnects carry the normal line current when the regulator is out of service their capacity must be selected in reference to line relay settings. The fuse capacity in any case is low enough to afford protection to the regulator coils when the disconnects function as by-passes



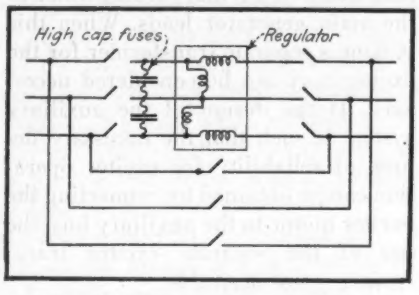
SERIES COILS in regulator are protected against circulating currents by fused by-pass disconnects

since the circulating current is very high because of the low impedance of the circuit.

•

Capacitors Reduce Induction Flash

To take a voltage regulator out of service requires by-passing and disconnecting the series coil, which includes no fireworks—unless something is wrong. But disconnecting the shunt winding is something else again. There is always a heavy induction flash when the circuit is opened. Inside a substation where, quite often, space is rather crowded, that flash may be pretty



CAPACITOR connected in parallel with regulator shunt winding eliminates induction flash when unit is disconnected

close to the operator, too close for his perfect comfort.

Following experiments in the transformer repair shop which proved the feasibility of the idea, it was decided to install capacitors ahead of regulators as shown in the accompanying diagram in substations where quarters are cramped. The capacitors will serve a useful secondary purpose in correcting substation power factor and cutting out a regulator will no longer be a spectacular and somewhat nervous job. There will have to be a fairly close matching of capacitive and inductive kva. as between the capacitor and the regulator to get maximum reduction of flash. A standard 15-kva. 2,300-volt capacitor matches the approximately 14-kva. exciting current of the regulator on which the experiments were made.

•

Metallic Sheaths, Shielding Grounded

3. Sheath Grounded at One Point*

RICHARD C. WALDRON
Assistant to the Chief Engineer, Okonite Co., Passaic, N. J.

Sheaths of single-conductor cable carrying alternating current will have a potential built up if grounded at only one point. The following table gives the maximum lengths which should be installed between insulating joints in order to keep this potential below the maximum safe value (approximately 12 volts for wet ducts and 25 volts for dry ducts).

These lengths are based on the most severe conditions likely to be encountered. They apply for any voltage a.c. cables. Many conditions will permit longer lengths between insulating joints. For example: where cables are operated at less than full load.

The lengths given are from the grounded point to the insulating sleeve. If the mid-point of the section is grounded the total length between insulating joints may be twice the lengths given. Special bonding methods obtain this result, such as bonding transformers having their mid-point grounded. Bonding transformers or reactances may also be used in place of solid grounds at one end.

Maximum lengths for single-conductor cables with sheaths insulated at joints and terminals and grounded at one end of section only.

Size Conductor	Cables in Separate Ducts Wet A ft.	Dry B ft.	Cables in Same Duct Wet A ft.	Dry B ft.
1/0	660	1,375	5,050	10,500
4/0	455	950	1,580	3,290
350	375	780	1,190	2,480
500	305	640	990	2,050
750	270	560	790	1,650
1000	240	500	.....	.....
2000	180	375	.....	.....

A. Wet ducts refer to those where the moisture conditions are severe enough to cause corrosion or electrolysis if the necessary chemical reagents or potentials are present. In general, all underground ducts should be considered as wet ducts.

B. Dry ducts are those where there is not sufficient moisture to permit corrosion or electrolysis. Conduit in buildings will, in general, meet this requirement.

The values given for dry conditions may be used for cables having moisture impervious coverings such as rubber or synthetic sheaths over the metal coverings when installed under either wet or dry conditions.

The above values apply to any cables with metal covering including lead sheaths, shielding tape, or armor. Obviously, cables having this metal as the outside covering cannot be installed in the same conduit and operated with insulated sheaths. However, a duck tape over the lead or a cotton braid over the shielding tape will provide sufficient insulation to allow operation with insulated sheaths.

* Other articles in this series were previously published in the Electrical World, September 30, 1944, page 95 and October 14, 1944, page 134.

Here's a Fuse Cutout That WILL SAVE YOU MONEY

wherever transformer secondaries are not banked

ENCLOSED, NONINDICATING
Over 1,500,000 in Service

1. Wet-process porcelain housing, glazed inside and out, has ample mechanical and insulation strength.
2. Barriers, on both housing and Textolite door, interleave to prevent conducting arc gases from bridging the contacts when high currents are interrupted.
3. Silver-plated, heavy-duty, self-aligning contacts of the high-pressure-blade type assure permanently low contact resistance, low operating temperature, and long life—even under heavy loading or unfavorable atmospheric conditions.
4. When the cutout door is opened, the fuseholder is removed from both contacts, and is safely isolated from the contacts by a generous clearance.
5. The fuseholder, which has silver-plated contact blocks, can be removed or inserted without tools. Even in the dark, it cannot be placed in the cutout door incorrectly. (The same is true of the disconnecting blade, which can be used in place of the fuseholder.)
6. The hanger clamps to the crossarm, and provides choices of vertical or down-tilted, and straight-out or swiveled positions of the cutout.

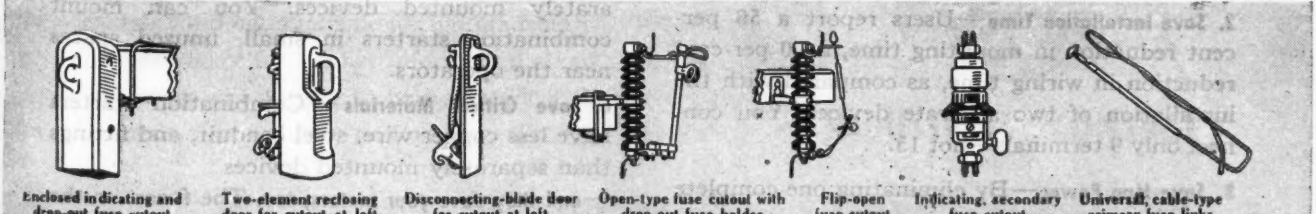
Stocked in 50- and 100-ampere, 5000-volt and 7500/12,500-volt Gr. Y ratings

Reliable in any weather - - works without moving parts

Lowest in price of all wet-process, porcelain-enclosed types, these nonindicating cutouts afford a considerable saving on transformer installations not having banked secondaries, where the location of a blown fuse is indicated by a phone call from the consumer whose service is interrupted.

Since these cutouts were introduced, in 1928, all contacts, fuseholders, and other parts have been interchangeable. Such standardization reduces your stocks and maintenance costs. For complete information, ask our local office for Catalog GEA-2489C. Or write General Electric Company, Schenectady 5, N. Y.

Remember these other G-E devices for complete, economical overcurrent protection



Enclosed indicating and drop-out fuse cutout | Two-element reclosing door for cutout at left | Disconnecting-blade door for cutout at left | Open-type fuse cutout with drop-out fuse holder | Flip-open fuse cutout | Indicating, secondary fuse cutout | Universal, cable-type primary fuse links

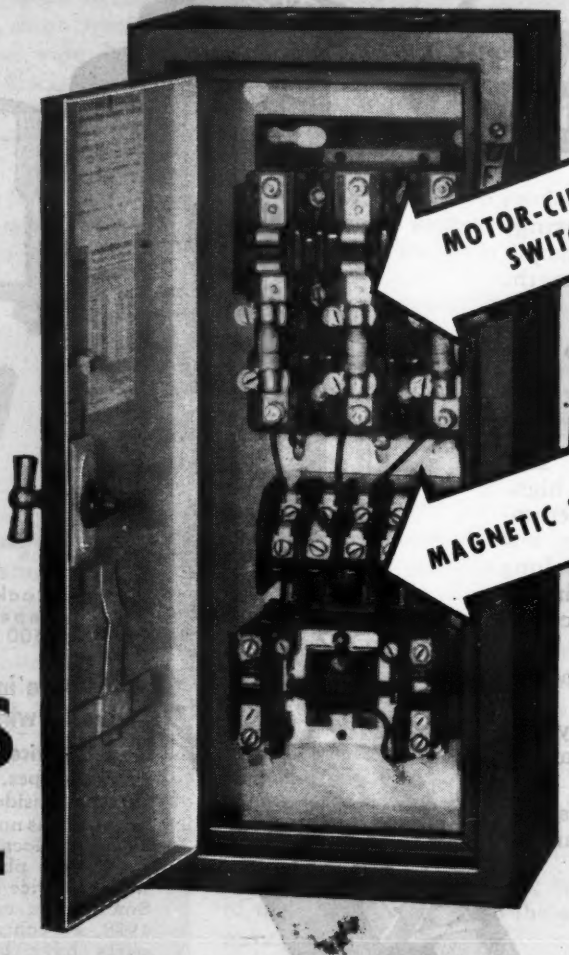
GENERAL ELECTRIC

BUY WAR BONDS

MOTOR STARTERS

EVERY TYPE,

DEPENDABLE . . . ATTRACTIVE IN APPEARANCE



BOTH IN ONE UNIT

For full-voltage starting of squirrel-cage a-c motors

YOU SAVE 6 WAYS WITH COMBINATION STARTERS

1. Save Ordering Time—Instead of buying two separately mounted devices, you buy one factory co-ordinated unit that controls and protects your motor.

2. Save Installation Time—Users report a 50 per-cent reduction in mounting time, a 40 per-cent reduction in wiring time, as compared with the installation of two separate devices. You connect only 9 terminals—not 15.

3. Save Man Power—By eliminating one complete mounting job on every installation, you save valuable man power.

4. Save Money—Cost slightly more than two separately mounted devices, but the difference is more than made up by the savings in wire, conduit, fittings, and installation-labor costs.

5. Save Wall Space—Take up less space than separately mounted devices. You can mount combination starters in small, unused spaces near the operators.

6. Save Critical Materials—Combination starters have less copper wire, steel conduit, and fittings than separately mounted devices

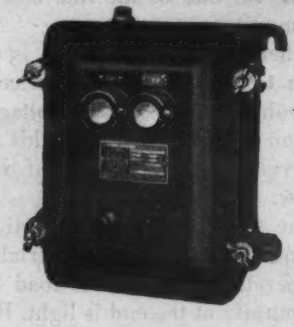
—and they save your motors, too. The fuses, or the breaker, are co-ordinated with the thermal overload relays to give complete motor protection under short-circuit or overload conditions.

EVERY KIND, FOR EVERY MACHINE APPLICATION

DESIGNED TO BLEND WITH MODERN MACHINES

Magnetic Full-voltage Starter—Designed to provide long life, ease of installation, readily accessible parts for quick inspection, and the dependability requisite to modern industrial needs.

Magnetic Full-voltage Starter—Showing Selector switch mounted in the cover of a general-purpose case.

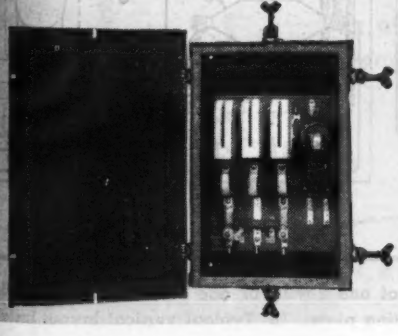


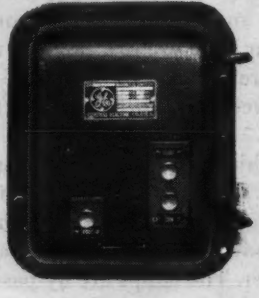
A-c Magnetic Starter with Watertight Case—Wall-mounted, overload-relay reset button in cover, and push button can be added.

Starter with Dust-tight Case—Fabricated, case of cold-rolled sheet steel—wall-mounted—overload-relay reset button in cover.

Oil-immersed General-purpose Starter—Suitable for use in corrosive atmospheres found in such places as chemical plants and oil refineries, or for outdoor use.

Starter for Hazardous Locations—Will withstand internal explosion—high tensile cast iron will meet hydrostatic pressure test—overload-relay reset button in cover.





NAME YOUR APPLICATION

G-E starters come in a variety of enclosures to meet any operating condition, and are available for motors from 1 to 1000 horsepower. Write today for further information about these starters—our engineers will be glad to help you select the correct type for your needs. *General Electric Company, Schenectady 5, N. Y.*

INDUSTRIAL CONTROL

GENERAL ELECTRIC

BUY WAR BONDS

676-133-R920

Compensated Compensator

By E. C. EDMONDS
Test Engineer, Electric Power Board, Chattanooga, Tenn.

At about the middle of a line extending out from the distribution system of the Chattanooga (Tenn.) Power Board, a tap is taken off to serve a fairly large industrial plant. At the far end of the line is a small community.

When the industrial load is on, in order to provide proper service to it, the point of reference for voltage regulation is taken at the tap. This means that voltage at the far end of the line is low.

The condition is not objectionable during the hours the industrial plant is operating because the load in the community at the end is light. But the community load picks up at noon and, of course, in the evening when the industrial load is off. At those times the low voltage condition can not be tolerated and the regulation reference point should be taken as at the community or near it.

Regulator Setting

Thus the compensator on the voltage regulator in the substation should have one setting for the morning and afternoon and another for noon and evening as the regulation reference point shifts back and forth between the middle and the end of the line.

This is accomplished in simple fashion. A couple of lamps of proper size are connected in series with the compensator and the contact-making voltmeter. The lamps are by-passed by the switch of a time clock. At noon and in the evening the clock opens the switch thus introducing resistance into the compensator circuit and moving the regulation reference point out to the end of the line. At the time the industrial load comes on the clock closes the switch and the reference point moves back.

The same result could be obtained by using the time clock to by-pass some of the resistance inside the compensator. But the lamps are a convenience; they avoid the necessity for disturbing the interior connections of the compensators. Also, by changing lamp sizes the value of the by-passed resistance can be varied in smaller increments.

How to Construct C.T. and P.T. Cabinets

The New England Power System has established standard construction for current and potential transformer cabinets through its meter engineering staff, for the convenience of su sidiaries properties. The details construction of these units are giv below.

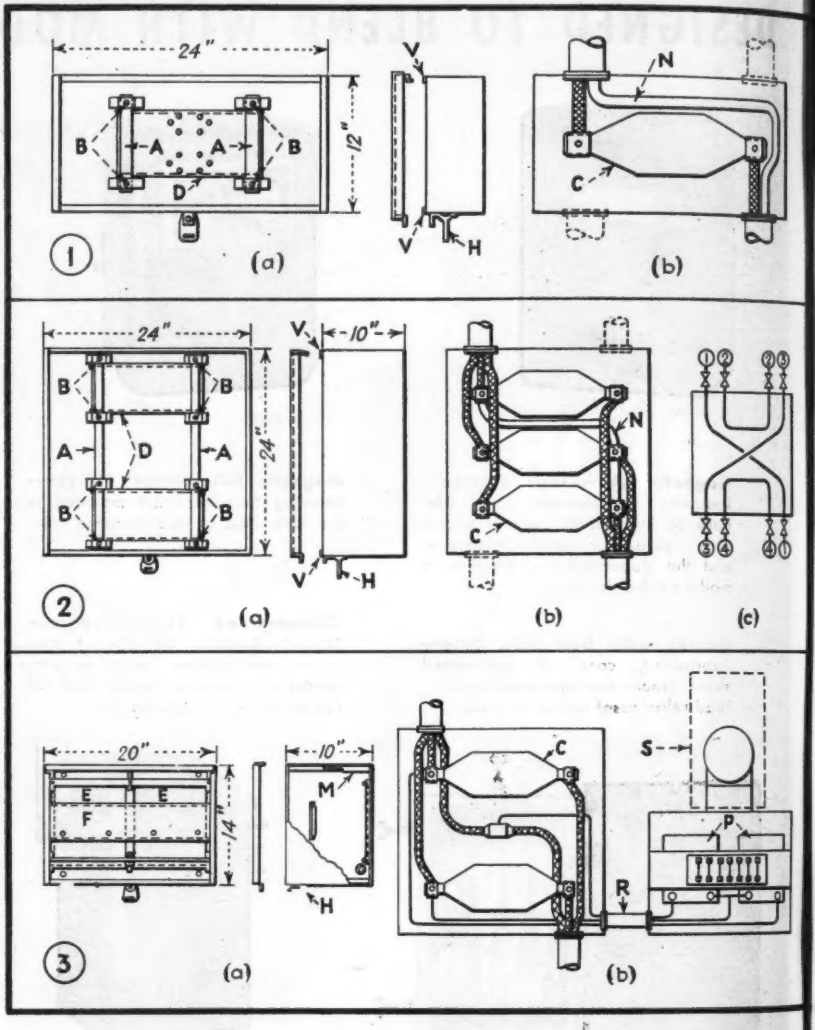


FIG. 1—(a) Cabinet for installation of one 2-wire or one 3-wire current transformer equipped with one transformer mounting plate. (b) Typical vertical layout installation

FIG. 2—(a) Cabinet for installation of two 2-wire or three 2-wire current transformers equipped with two transformer mounting plates. (b) Typical vertical layout installation. (c) Schematic diagram (cabinet vertical) showing 8 possible service-to-load feeds; cabinet may be turned 90 deg. for use in horizontal position

FIG. 3—(a) Cabinet for installation of two 600-volt potential transformers. (b) Typical layout for 575-volt installation with C.T.'s and P.T.'s

References and Notes

A—Bars (A) serve to clamp C. T. mounting plates under pressure of set screws (B)
C—Current Transformer
D—Removable C. T. mounting plate
E—Removable P. T. mounting plate
F—Test switch mounting plate
H—Cover hasp
M—Reversible meter trim
N—Neutral
P—Potential transformer
R—1¼-in. conduit for C. T. secondary a P. T. primary
S—Spacer trim required for recording d mand watthour meter
V—Cover spacers to provide ventilation
Standard C. T. mounting plates are ½ in high. A plate 2 in. high is used to pro vide mounting for third C. T. in 24 x 24 x 10-in. cabinet
Removable C. T. mounting plates a punched for all 4,500-, 5,000-, 600- C. T.'s later than W-12
Solderless primary terminals are used

A RECORD THAT'S HARD TO BEAT

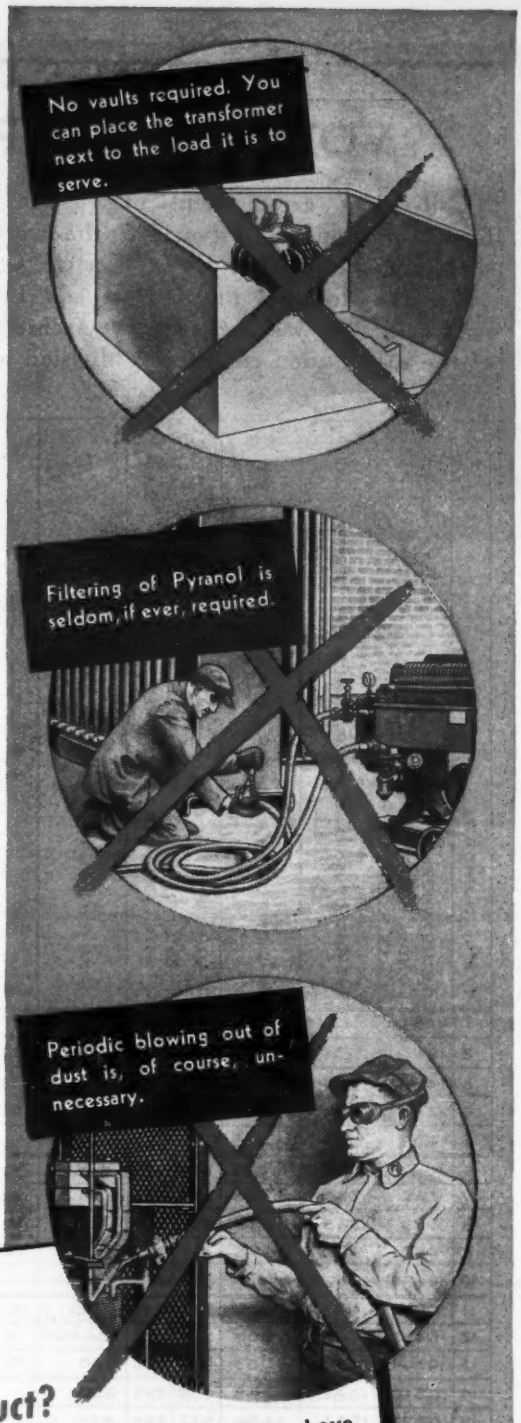
It's the reason for the trend to Pyranol transformers

1. OPERATING RECORD 99.8 PER-CENT PERFECT—based on careful records of 12,000 Pyranol* transformers, totaling 2,000,000 kva, installed from 1932 to 1943 in *industrial plants*. In this ten-year period there have been *only* 23 failures.

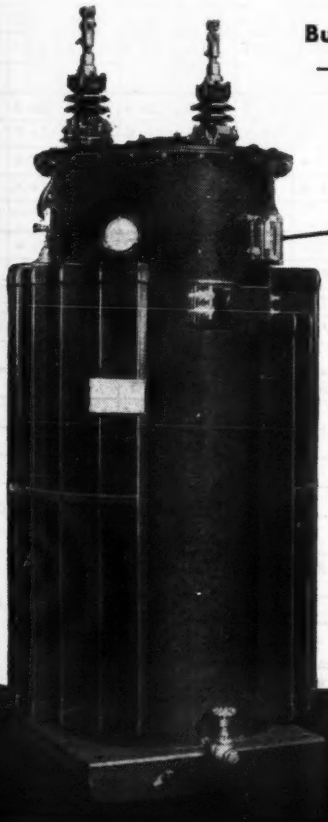
2. NEVER A FAILURE DUE TO PYRANOL. In *not one* of these 23 failures reported during this ten-year period did the fact that the cooling liquid was Pyranol have anything to do with the failure. Furthermore, in not one of these 23 cases was anyone harmfully affected physically.

3. NEVER A FIRE WITH PYRANOL. In *no case* has Pyranol burned or contributed to a fire. In *no case* has its vapors formed explosive mixtures with the air. The National Electrical Code permits the use of Pyranol transformers indoors *without* the use of fireproof vaults.

*Reg. U. S. Pat. Off.


No vaults required. You can place the transformer next to the load it is to serve.
Filtering of Pyranol is seldom, if ever, required.
Periodic blowing out of dust is, of course, unnecessary.

Buy all the BONDS you can —and *keep all you buy*



Can you ignore the economic benefits of this time-proved product?

Why should you accept anything short of the greatest reliability, for your power supply? Can you afford unnecessary capital investment in such items as vaults and heavy copper, necessary when oil-filled transformers are used for industrial distribution? Can you afford to have your transformers exposed to dirt, dust, or oil vapors? Can you afford to ignore an operating record such as Pyranol transformers have produced?

For safety, savings, and reliability, specify Pyranol for your next indoor installation of transformers or load-center unit substations. Pyranol units are available for circuits up to 69,000 volts —our new bulletin, GEA-4193, will bring you additional facts. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

VOLTAGE DROPS FOR 60-CYCLE CIRCUITS

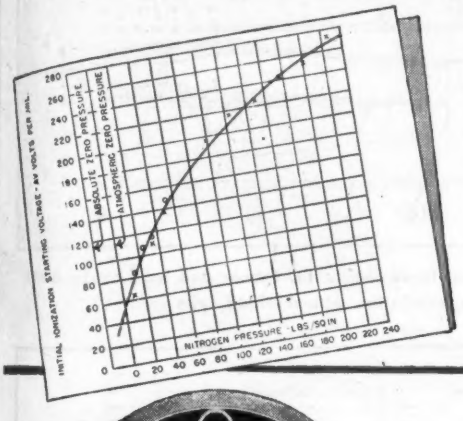
Convenient arrangement of voltage drop information appears on one of the working data sheets of the Quebec Hydro-Electric Commission (formerly Montreal Light, Heat and Power Consolidated). It was prepared by Archie Benjamin of the distribution engineering division and covers a wide range of copper sizes, spacing and configuration as well as some characteristics of copper conductors for 1000-ft. lengths. A particularly useful supplementary chart shows how the unequal impedances divide the total current between two dissimilar circuits in parallel.

ITEM NUMBER	RESISTANCE OF 1000 FT OF COPPER STRANDED CONDUCTOR IN OHMS (20°C ; 97% CONDUCTIVITY) $R_{T_2} = R_{20°C}\{1 + .00381 (T_2° - 20)\}$	WEIGHT OF BARE COPPER CONDUCTOR PER 1000 FT.		WEIGHT OF P.B.W.P COPPER CONDUCTOR PER 1000 FT	AMPERES TO GIVE A TEMPERATURE RISE (ABOVE 25°C) OF BARE STRANDED COPPER CONDUCTOR WITH AVERAGE TARNISHED SURFACE IN STILL AIR		SIZE OF CONDUCTOR - B&S OR CIRC. MILS		VOLTAGE DROP PER 1000 FT. OF CIRCUIT FOR 100 AMPERES - 60 CYCLES												ITEM NUMBER
									90% P.F.				80% P.F.									
									SPACING 8"		8"		FLAT 8"		Δ 20"		Δ 20"		Δ 24"		Δ 36"	
									115 VOLTS - 2 WIRE OR 230 VOLTS - 2 WIRE		115/230 VOLTS - 3-WIRE (DROP TO NEUTRAL)		575 VOLTS - 3-PHASE 3-WIRE		2300 VOLTS - 3-PHASE 3-WIRE (FOR SINGLE PHASE SEE NOTE IN COLUMNS 16 & 17		4000 VOLTS - 3-PHASE - 4-WIRE - DROP TO NEUTRAL (FOR DROP BETWEEN WIRES 2300 VOLTS - SINGLE PHASE - MULTIPLY BY 2		12000 VOLTS - 3 PHASE - 3-WIRE		24000 VOLTS - 3 PHASE - 3-WIRE		
					40°C	60°C			WIRE	1-COND CABLE	WIRE	1-COND CABLE	WIRE	3-COND CABLE	WIRE	3-COND CABLE	WIRE	3-COND CABLE	WIRE	3-COND CABLE	WIRE	3-COND CABLE	
1	1.051	SOLID WIRE	31.4	SOLID WIRE 46			SOLID WIRE #10																1
2	.662		50.0	66			8		127.0	123.2	63.5	61.6	102.5	94.8	104.0		60.2		104.5		105.5		2
3	.416		79.5	100	90	117	6		83.0	78.6	41.5	39.3	68.4	61.0	70.0	61.7	40.5	35.7	70.5	70.0	71.5		3
4	.262		126.4	151	128	160	4		55.4	50.6	27.7	25.3	47.1	39.7	48.7	40.3	28.2	23.3	49.2	45.8	50.1		4
5	.208		159.3	185			3																5
6	.165		200.9	239	173	216	2		37.8	33.0	18.9	16.5	33.2	25.9	34.8	26.4	20.2	15.3	35.4	30.0	36.3		6
7	.131		256.4	303	197	245	1		32.0	26.8	16.0	13.4	28.7	21.0	30.3	21.4	17.5	12.4	30.8	24.5	31.7		7
8	.103		323.6	388	230	287	1/0		26.8	21.6	13.4	10.8	24.6	17.1	26.2	17.4	15.1	10.1	26.6	20.0	27.6		8
9	.0821		408.1	482	265	330	2/0		22.8	17.8	11.4	8.9	21.4	14.1	23.0	14.5	13.3	8.4	23.4	16.5	24.4		9
10	.0650		514.3	604	310	390	3/0																10
11	.0515		649.1	745	357	446	4/0		16.8	12.2	8.4	6.1	16.6	9.8	18.2	10.1	10.5	5.9	18.7	11.6	19.6		11
12	.0437		772.0	907	395	492	250 MCM		15.2	10.6	7.6	5.3	15.3	8.7	16.9	9.0	9.8	5.2	17.4	10.2	18.4		12
13	.0364		925.3	1083	438	552	300 "		13.7	9.4	6.8	4.7	14.1	7.7	15.7	7.9	9.1	4.6	16.1	9.1	17.1		13
14	.0312		1082	1248	480	595	350 "			8.4	6.3	4.2	13.2	6.9	14.9	7.2	8.6	4.1	15.2	7.6	16.3		14
15	.0273		1236	1436	522	660	400 "			7.6		3.8	12.5	6.3	14.1		8.1		14.5		15.5		15
16	.0219		1543	1765	612	762	500 "		10.6	6.6	5.3	3.3	11.5	5.6	13.1	5.8	7.6	3.3	13.5	6.6	14.5		16
17	.0182		1853	2093	697	870	600 "																17
18	.0156		2160	2471	763		700 "																18
19	.0146		2316	2635	805		750 "		9.0	5.2	4.5	2.6											19
20	.0109		3086	3456			1000 "		8.0		4.0												20

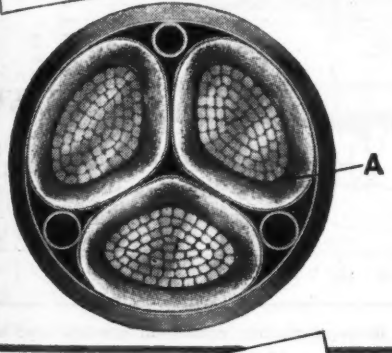
COMPARATIVE AMPERES CARRIED BY DIFFERENT SIZE 3-PHASE CIRCUITS OPERATING IN PARALLEL - 80% P.F

ITEM NO		VOLTAGE	SIZE OF COPPER												
			500 MCM	400 MCM	350 MCM	300 MCM	250 MCM	4/0	2/0	1/0	1	2	4	6	8
1	WIRE	12 KV	100	93	89	84	78	72	58	51	44	38	27	19	13
2	CABLE	12 KV	100	94	86	73	64	57	40	33	27	22	14	9	7
3	WIRE	4 KV	100	93	88	83	77	72	57	50	43	38	27	19	13
4	CABLE	4 KV	100	88	81	73	64	57	40	33	27	22	14	9	6

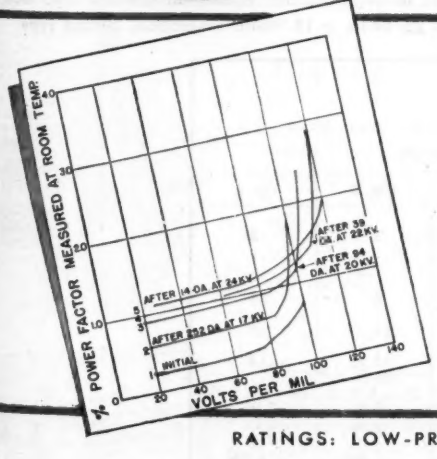
What we mean when we say this cable is SELF-HEALING UNDER STRESS


INITIAL IONIZATION STARTING VOLTAGE - KV VOLTS PER MIL
ABSOLUTE ZERO PRESSURE
ATMOSPHERIC ZERO PRESSURE
NITROGEN PRESSURE - LBS./SQ.IN.

SUPPRESSION OF THE IONIZATION that occurs under voltage stress is vital to the dielectric strength and life of cable insulation. This ionization begins in the tiny pockets of gas in the voids and butt spaces of the paper-tape wrappings. The first factor acting to minimize it, in gas-filled cable, is the pressure of the gas itself (see chart). Within the safe limits of lead-sheath strength, higher pressures permit higher voltage stresses before ionization begins.



DISTRIBUTION OF IMPREGNATING COMPOUND so as to fill the critical voids in the high-stress fields (A) is a further defense against cumulative ionization effects. In G-E mass-impregnated, gas-filled cable, "automatic grading" helps concentrate the mobile impregnating compound at the points of greatest stress, (A). Then, should ionization persist from overvoltage, still another factor comes into action.


% POWER FACTOR MEASURED AT ROOM TEMP.
VOLTS PER MIL
AFTER 39 MA. AT 22 KV.
AFTER 84 DA. AT 20 KV.
AFTER 14 DA AT 24 KV.
AFTER 232 DA AT 17 KV.
INITIAL

AS THE MOBILE IMPREGNATING COMPOUND used in G-E gas-filled cable is drawn into ionized gas pockets by electrostatic attraction, it changes chemically to a form known as "X-wax." This formation of X-wax continues until voids are filled. Ionization is extinguished. *Self-healing* has taken place.

Taken together with the self-supervising feature which warns of sheath damage, this *self-protecting ability* of G-E mass-impregnated gas-filled cable helps explain why we regard it as tomorrow's universal cable-type within its recommended voltage range. ***General Electric Company, Schenectady 5, New York.***

RATINGS: LOW-PRESSURE TYPE, 10 to 40 KV; MEDIUM-PRESSURE TYPE, 40 to 69 KV

GENERAL ELECTRIC

501-24-1200

BUY ALL THE BONDS YOU CAN—AND KEEP ALL YOU BUY

CONSTRUCTION OF STRAIGHT JOINT FOR ROUND CONDUCTOR CABLE

Four straight joints designed for 250,000 cir. mil conductor lead cable, suitable for underground or aerial service and for three different operating voltages of grounded or ungrounded systems. Accompanying outlines are adapted from construction standards of The United Illuminating Co., New Haven and Bridgeport, Conn. These are normal standards and do not reflect wartime shortages of materials. Table lists items and quantities of material required.

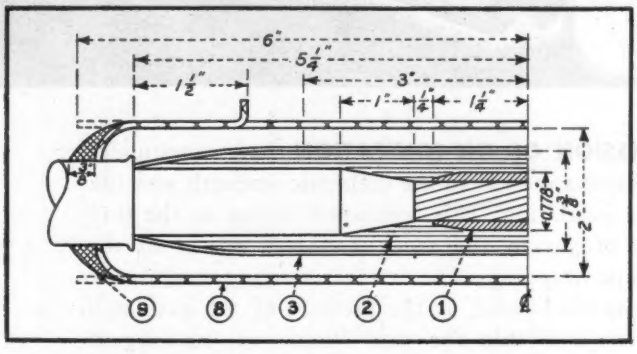


Fig. 1—Joint for single-conductor, rubber and lead cable, 2,300 volts, 12/64-in. insulation, non-shielded type

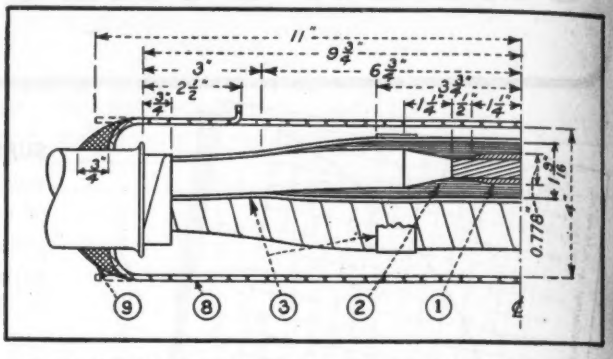


Fig. 2—Joint for three-conductor, rubber and lead cable, 6,900 volts, 16/64-in. insulation, non-shielded type

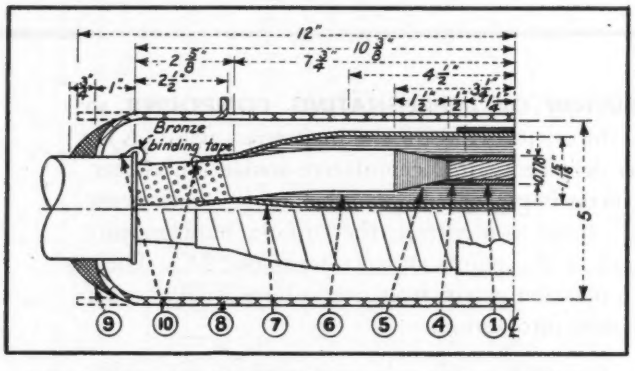


Fig. 3—Joint for three-conductor, varnished cambric and lead cable, 13,800 volts, 19/64-in. insulation, shielded

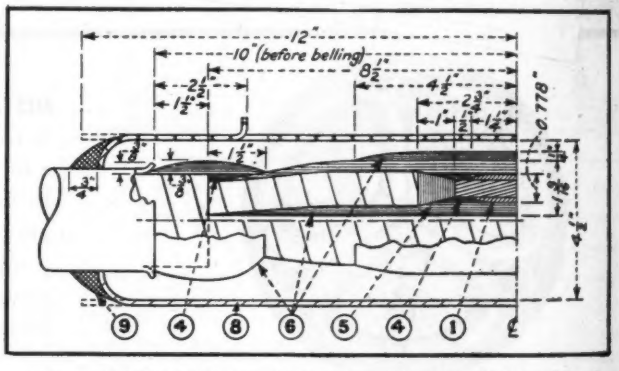


Fig. 4—Joint for three-conductor, varnished cambric and lead cable, 13.8 kv. 13/64-in. x 13/64-in. insulation, belted type

List of Material

Item	Description	Quantity			
		Fig. 1	Fig. 2	Fig. 3	Fig. 4
1	Connector, 250,000 cir. mil, NELA Spec	1	3	3	3
2	Rubber splicing tape	½ lb.	3 lb.	....	....
3	Friction tape, ¾-in	½ lb.	1½ lb.	....	....
4	Bias cut V. C. tape, ¼-in. x 0.010 in., 4-yd. roll	....	....	6	35
5	Bias cut V. C. tape, ¾-in. x 0.010 in., 4-yd. roll	....	....	12	5
6	Bias cut V. C. tape, ¾-in. x 0.010 in., 16-yd. roll	....	....	15	13
7	Copper mesh braid, ¾-in	....	....	66 ft.	....
8	Lead sleeve, inches	12 x 2 x 1/32	22 x 4 x 1/32	23 x 5 x 1/32	24 x 4½ x 1/32
9	Wiping solder, 40% tin x 60% lead	1 lb.	5 lb.	8 lb.	7 lb.
10	Stick solder, 50% tin x 50% lead	½ lb.	½ lb.	½ lb.	½ lb.
11	Basting oil	....	....	2 qt.	2 qt.
12	Filling compound	1 qt.	1 gal.	2 gal.	1½ gal.
13	Stearine	1 oz.	2 oz.	2 oz.	2 oz.
14	Asbestos roving	2 ft.	5 ft.	5 ft.	5 ft.
15	Gilling thread	....	....	10 ft.	....
16	Cotton tape, ¾-in	4 ft.	10 ft.	10 ft.	10 ft.
17	Paper pasters, 2-in	2 ft.	5 ft.	5 ft.	5 ft.
18	Rubber cement	2 oz.	4 oz.	....	....
19	Aloxite cloth	1 ft.	1 ft.	1 ft.	1 ft.

Rolled metal edge makes cutout strong, easy to install.
Oxidized-copper dielectric element gives excellent uniformity of operation.
Stiff fiber insulation makes cutout mechanically sturdy. Also excludes moisture.

For low-cost, dependable FILM CUTOUTS

for your series-lighting sockets specify "G-E Novalux"

They're DESIGNED to

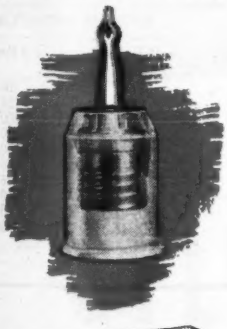
- *Reduce servicing time*
- *Prevent "duds" due to handling*
- *Minimize unscheduled "blackouts"*

Small as they are, cutouts can make a big difference in the continuity and the service costs of your series lighting.

G-E Novalux copper-oxide film cutouts are built to unusually high uniformity, mechanically and dielectrically. They are not affected by heat, dampness, or pressure. The oxidized-copper dielectric element is enclosed in a moisture-proof aluminum and fiber casing which resists damage and will not come apart.

Of course, G-E Novalux cutouts are standard equipment for G-E Novalux series sockets—but regardless of what makes of sockets are installed in your system, you can use Novalux film cutouts as replacements.

For further information, write or phone the nearest G-E office. *General Electric Company, Schenectady 5, N.Y.*



These sturdy, high-quality series sockets will save time and money on maintenance, and will prevent many service outages. They withstand temperature changes, vibration, and atmospheric corrosion that have often caused street lighting sockets to fail. They are standard equipment for G-E Novalux luminaires—but they can also be used as replacements in any series luminaires you are using.

Novalux Renewal Parts catalog—complete, well illustrated—facilitates checking stock and ordering parts. Write for a copy of GEA-4084.

Buy all the BONDS you can
—and keep all you buy

Novalux
RENEWAL PARTS
for Luminaires

GENERAL ELECTRIC

452-2u-3010

HOW TO SELECT A SYNCHRONOUS MOTOR

By K. M. PATTERSON, Motor Specialist, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

✦ ✦ ✦

Plant engineers will find this table helpful in selecting proper synchronous motors for their particular applications.

First, pick torques in the proper speed range—refer to machinery manufacturers specifications. Second, check starting kva—power company specifications or limitation of generating facilities should be considered. Third, select desired starting kva—starting method which will give the required starting kva can be selected to match torque condition.

Example 1. A compressor is being purchased for an air-conditioning installation. Although no power factor correction is needed, it is desired to use a direct-connected synchronous motor. The compressor requires a motor rated 100 hp., 50 deg. C., 100 percent power factor, 208 volts, 3 phase, 60 cycle, 360 rpm., the motor having starting torque of 50 percent, pull-in torque of 50 percent and pull-out torque of 150 percent.

The compressor normally starts unloaded and in this case, the standard motor has sufficient flywheel effect to limit the current pulsation to a satisfactory value.

Since the compressor speed is 360 rpm., a low-speed synchronous motor would be used. In the table, under the heading "Low-Speed," appears 275 percent starting kva. for motors having the required torques.

For this installation, the power company has no limitation on the total starting kva. permitted, but there is a limit on the kva. per step, 150 percent of the rated kva. of the motor. By referring again to the table, it is seen that this can be obtained by either a "series reactor" or a "series resistor," two step starter.

Example 2—A smelter is installing a new ball mill that will require a motor rated 300 hp. at 164 rpm. An 80 percent leading power factor motor is desired to obtain power factor correction. The ball mill requires motor torques of 200 percent starting, 120 percent pull-in and 175 percent pull-out. By referring to the table in the low speed group, we find that there are three torque combinations that will meet this requirement. However, the mill generates its own power and the peak permissible starting kva is 400 percent of normal motor full load kva. The motor with 365 percent inrush meets this limitation of the generating facilities and should be selected. This is a low speed, coupled type synchronous motor.

The autotransformer starter does not appear in the table. It performs the same as the reactor and resistance starters in regard to starting torque which varies as the square of the voltage. But while the starting kva. varies directly with the voltage in the cases of the reactor and resistance starters, it is proportional to voltage squared in the case of the autotransformer.

Low Speed, 450 rpm. and below (60 cycles)

TORQUES with full voltage applied to motor (in percent of Full-Load Torque)			STARTING KV-A (in percent full load kv-a) (Based on 100% P.F. Motors)		REDUCED STARTING KV-A METHODS by reduced voltage (kv-a per step in percent full-load Kv-a)		
					INCREMENT STARTERS		
			Full-Voltage Squirrel-Cage Starting	Across-the-line Wound-Rotor Type Starting *	SERIES REACTOR	SERIES RESISTOR 2 Point	SERIES RESISTOR 3 Point
Starting	Pull-in	Pull-ou					
35–40	30–35	140	225	.....	125	125	.....
40–50	40–50	150	275	.....	150	150	100
50	60–75	150	325–350	.....	175	175	125
80	110	150	475	.....	275	275	200
60	100	150	425	.....	225	225	150
100–125	50–60	150	400	.....	225	225	150
100–125	100	150	500	.....	275	275	150
50–75	65	250–300	450–525	.....	275–325	275–325	225
80–100	100–110	250	550–600	.....	300–400	300–400	250
125–150	100	200–250	550–625	.....	300–400	300–400	250
150–200	100–125	175–250	550–750	.....	350–450	350–450	200–300
150–200	100–125	175–250	.....	450–550	.....	.....	.....
150–200	100–125	175–250	.....	265–365	.....	.....	.....

High Speed, 514-1800 rpm. (60 cycles)

50–60	50–50	150–175	300–350	.....	.....	.....	.....
80–100	50–60	150–175	350–400	.....	175–250	175–250	125–150
60	100–110	150–175	400–450	.....	200–250	200–250	150–175
100–125	100	150–175	500	.....	275	225	150
50–75	65	250–300	450–525	.....	275–325	275–325	225
80–100	100–110	250	550–600	.....	300–400	300–400	250
125–150	100–110	250	550–625	.....	300–400	300–400	250
150–200	100–125	175–250	550–750	.....	350–450	350–450	200–300
150–200	100–125 (514–720 rpm)	175–250	.....	450–550	.....	.....	.....

*Synchronous Motor with phase wound damper winding.

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G-E PYREX PLUG FUSES

For Branch Circuit Protection

(3-30 Amp., 125 Volts)

G-E Pyrex* Plug Fuses will give lasting protection. They are carefully made of the finest materials. They are easy to use and have an insulated grip. Ratings can be read at two points: on the fuse link seen through a magnifying lens window and on the contact rivet at the base of the fuse.

G-E Pyrex Plug Fuses are well designed. They have a cold-molded base which is keyed into the Pyrex top so that there is little chance of turning and damaging the link. The shell holding the Pyrex top and the base together is staked securely into the base. This construction provides strength in the fuse.

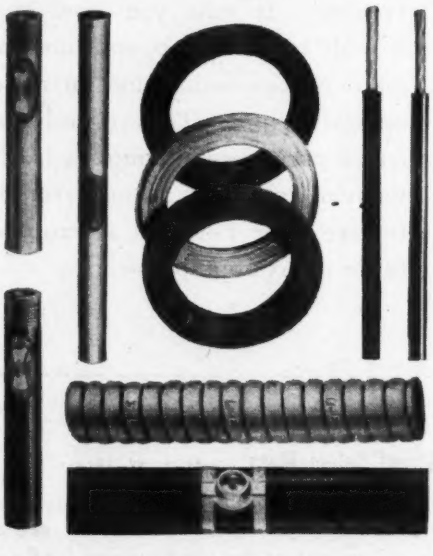
G-E Pyrex Plug Fuses are packed in handy fuse dispenser cartons—five fuses to a carton. These cartons are ideal for users because they can be tacked up near fuse panels.

*Reg. U.S. Pat. Off.

FOR FURTHER INFORMATION on G-E Pyrex Plug Fuses or G-E Conduits or G-E Wires and Cables, see the nearest G-E Merchandise Distributor or write to Section CDW1045-9, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

G-E CONDUITS AND BUILDING WIRES

General Electric offers conduits and building wires for every purpose: G-E White and G-E Black rigid conduits, EMT, flexible metal conduit, Fiberduct and various building wires including Type SN and Type SNW thermo-plastic insulated, small diameter Flamenol* Building Wire.



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On adequate wiring, Philip A. Benson, president of The Dime Savings Bank of Brooklyn, N. Y. says, "We shall require adequate wiring in the new post war homes that we finance, not only as a guarantee of comfortable living for the mortgagor, but also as a measure of protection for our investment."

ADEQUATE WIRING — THE KEY TO THE HOME OF TOMORROW

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GENERAL ELECTRIC

Blasting Without Fouling Power Lines

Seismic blasting in oil prospecting operations can usually be carried on in the proximity of high voltage lines if precautions are taken to prevent the blast-charge lead wires being blown upward into the overhead conductors.

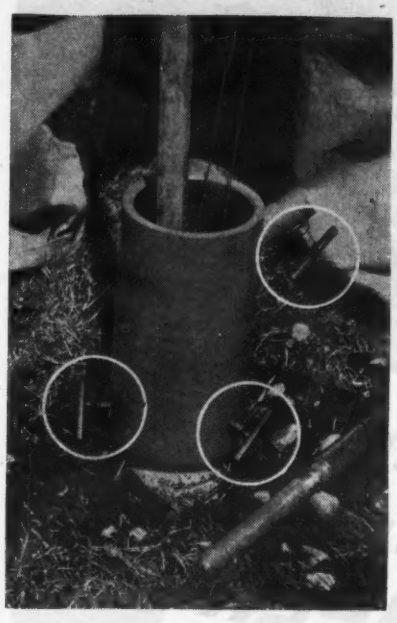
Two methods of achieving this have been successfully used and are now the accepted practice of Magnolia Petroleum Co. of Dallas, Texas, and described by M. D. McCarthy in a recent issue of the Explosive Engineer. One is for open-hole blasting and the other for cased-hole shots. In the open-hole method a piece of tapered cold-rolled steel shafting one in. in diameter and approximately 4½ ft. long is driven into the ground about a foot from the shot hole opening at such an angle that it enters the shot hole several feet below the surface. It comes to rest in an oblique position with the wall just short of the opposite side of the hole. The rod is left in this position during the blast.

SHOT-MAN removing pointed rod (used in open-hole method) by twisting and pulling with a pipe wrench

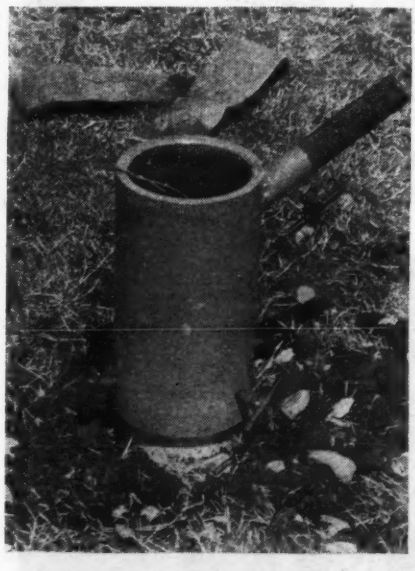
The cap-lead wire which is thrown upward by the concussion is caught by that portion of the rod which protrudes into the hole and thus prevents it from flying into the air. This would be more positive should the point of the rod pass between the two-twisted cap-lead wires.

The rod is removed each time hole is reloaded by pulling and twisting with a pipe wrench. Replace the rod in the same hole for the next shot.

In a cased-hole shot the two illustrations are self-explanatory. This rod can be much shorter than the spike used in the uncased hole and is even more easily removed for reloading. It, too, stops just short of the opposite side of the wall of the pipe. The success of both systems depends on placing the obstacle only part way through the shot hole—from three-quarters to four-fifths of the hole's diameter.



LOADING for a cased-hole shot. The three winged nuts at the bottom of the 14-in. heavy duty pipe engage the steel pipe below its collar. The purpose of the winged nut on the steel tubing which is welded to the pipe as shown is to engage the wire-catching steel pin. The pin which is undercut is lying on the ground at right of the hole

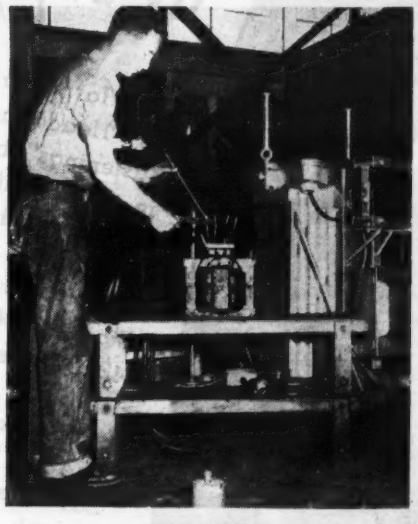


APPARATUS all set up ready for the cased-hole shot. Pin is in position with winged nut set tight. Leads blown up by the exploding charge are caught by the pin

Resistance Heating For Quick Soldering

By M. A. BROWN
Southern California Edison Co.
Alhambra, Calif.

As a source of immediate and inexpensive heat for soldering joints in busbar copper up to ¼ in. x 4 in., for transformer leads and for removing or soldering on lugs and other similar jobs at its Alhambra shops, Southern California Edison Co. passes a current of several hundred up to 2,000 amp. through the work by means of the equipment illustrated. The primary winding from an old 7½-kva. distribution transformer was removed and replaced with several turns of 1,000,000 cir.mil cable and placed in an old 75-kw. transformer case. With this as a secondary winding and the original 240-volt secondary as primary, currents up to 2,000 amp. can be obtained for resistance heating of the work to be done.



SILVER soldering transformer leads with high-current resistance heating requires only a few seconds

The heavy current is passed through the work by means of carbon tipped tongs and heavy flexible leads as shown. Value of the current may be adjusted over wide limits by means of a hinged core reactance in series with the 240-volt primary winding of the transformer. This, together with the switch and fuses and a foot-controlled contactor, shown, complete the equipment.

Silver soldering with some of the trade brand silver solders on the market is now being extensively used by this company because of its higher melting point (1,175-1,500 deg. F.)

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and its non-corrosive, high strength and ductile characteristics that fill a long felt want in the field of soldering for many types of electrical work.

•

Fire Hazards And Their Elimination*

Fire protection in bus rooms, vaults, manholes, and precautions to safeguard operators are outlined here.

A. Bus-Room Installations — Bus rooms usually contain a complex assembly of cells, bus work and electric apparatus. Adequate fire protection can generally be provided by portable water-spray nozzles connected to a sufficient number of 1½-in. hose lines from building standpipe system or even from yard hydrants, if nearby. Precautions to safeguard the operator of spray equipment must be observed, in conformity with the local conditions (for leakage currents and safe distances see ELECTRICAL WORLD Nov. 27, 1943 page 55). At the higher voltages and with close tolerance to exposed conductors, the bus circuits must be de-energized before water spray can safely be applied. On lower voltages with ample working clearances, de-energizing is not essential to safety of operators, although desirable for assurance against breakdown of insulation.

Spray nozzle and hose should be effectively grounded for operator's protection. Gas mask should usually be worn to protect operator against fumes from burning insulation. Special training and periodic drill in this type of fire fighting should be given to employees in operating and maintenance departments, who may be called upon to deal with bus-room fires.

Another method for protecting bus rooms is to provide facilities for flooding the entire room with carbon dioxide, actuated automatically by thermostats or controlled manually. Particular care must be taken that all employees leave the room before flooding, in order to avoid asphyxiation.

Provision for promptly clearing the room of smoke and fumes after fire has been extinguished is needed, irrespective of whether water spray, carbon dioxide or other protection is used. This may be by natural ventila-

* This series began in ELECTRICAL WORLD, September 2, 1944, page 100; adapted from "Handbook of Fire-Safety Practices for Public Utility Property," Ebasco Services Incorporated, New York, N. Y.

Famous for LONG LIFE!

Tobe Capacitors are *built* to last. From winding to shipping, each step is under rigid inspection to maintain the high standard set by twenty years' experience.

Below is shown a Tobe RLO Type Capacitor. It is impregnated and filled with mineral oil, made with watchful care and—like all Tobe Capacitors—rated conservatively. Let us know about *your* capacitor problems.

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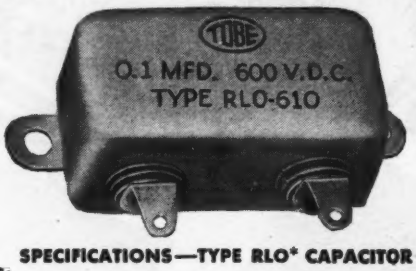

SPECIFICATIONS—TYPE RLO* CAPACITOR

RATINGS:

600 VDC	Single Units	.01 to 2.0 Mfd.
	Dual Units	.05 to 1.0 Mfd.
	Triple Units	.05 to 0.5 Mfd.
1,000 VDC	Single Units	.01 to 1.0 Mfd.
	Dual Units	.05 to 0.5 Mfd.
	Triple Units	0.1 and .25 Mfd.

STANDARD CAPACITANCE TOLERANCE—plus or minus 20%**

TEST VOLTAGE—twice D.C. rating

GROUND TEST—2,500 Volts D.C.

OPERATING TEMPERATURE—55° F. to 185° F.

SHUNT RESISTANCE—

.01 to 0.1 Mfd.	—20,000 Megohms
.25 to 0.5 Mfd.	—12,000 Megohms
1.0 Mfd.	—10,000 Megohms
2.0 Mfd.	— 5,000 Megohms

POWER FACTOR —1,000 cycles—.002 to .005

MOUNTING HOLE CENTERS: 2⅛" except for the following capacitance values which are made in containers having 2⅜" mounting centers:

600 VDC—	Single Units	1.0 and 2.0 Mfd.
	Dual Units	0.5 and 1.0 Mfd.
	Triple Units	.25 and 0.5 Mfd.
1,000 VDC—	Single Units	0.5 and 1.0 Mfd.
	Dual Units	.25 and 0.5 Mfd.
	Triple Units	0.1 and .25 Mfd.

*Data sheets showing complete code number for units having a specific capacitance value and voltage rating available on request.
**Other tolerances available.

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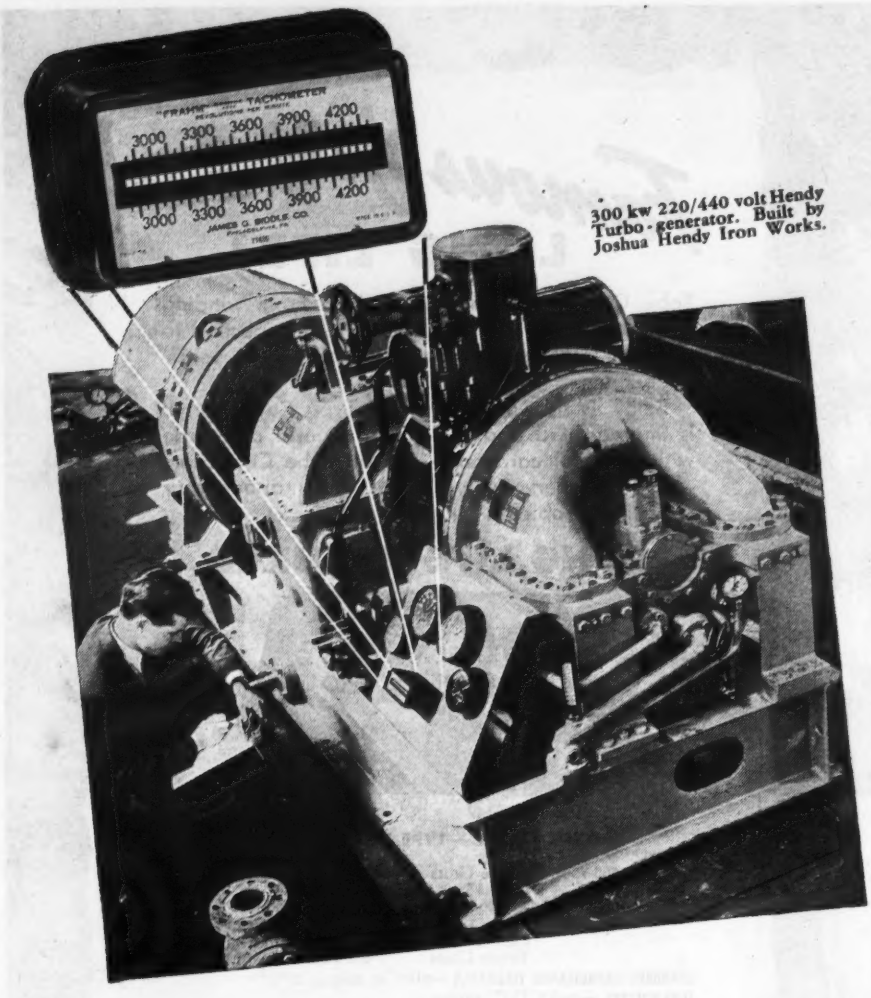
Photo Courtesy of Southern Pacific Lines



300 kw 220/440 volt Hendy Turbo-generator. Built by Joshua Hendy Iron Works.

. . . making "ASSURANCE DOUBLY SURE" with the "FRAHM" RESONANT-REED TACHOMETER

In the modern turbo-generator, uniformity of speed must be maintained over the entire range of no-load to overload conditions.

The Hendy unit shown above has a carefully designed and precisely built governor to assure uniform speed under widely varying load conditions. As a double check, however, Frahm Resonant Reed Tachometers are used on Hendy and other well-known turbo-generators, both large and small, to provide the operator with constant proof of turbine speed. Manufacturers select Frahm instruments for this service because of their simplicity of construction, ease of installation and freedom from maintenance.

Frahm Tachometers are built in both stationary and portable types for use on many kinds of machines having rotating parts. Various ranges are available from 900 to 60,000 r.p.m.

For a complete description of Frahm Tachometers together with list of types and ranges commonly supplied, write for Bulletin 1590-W. The instrument shown above is listed in Bulletin 1740-W.

JAMES G. BIDDLE CO. 1211-13 ARCH ST. PHILADELPHIA 7, PA.

tion, if adequate, or by forced ventilation with either permanently installed or portable fans. Practice in quick smoke removal should be included in the instruction on bus-room fire protection.

B. Vaults—Combating of fires in transformer vaults located in streets or within buildings requires knowledge as to kind and arrangement of equipment in vault, and the provisions for isolation and for access. Procedure in general involves following steps:

Disconnecting circuits on primary and secondary sides, if feasible

Cutting off air circulation, as far as possible

Applying extinguishers to put out fire and cool the equipment

Draining out any accumulation of oil or water.

Preferred extinguisher types are water spray, carbon dioxide and dry compound, but other kinds can also be used if all circuits and equipment in the vault can be disconnected. Capacity of extinguishers should be sufficient to allow at least two discharges since flash-back is likely to occur if metallic parts have become heated to high temperature.

In the case of outdoor vaults covered by grating, air supply may be choked by putting asbestos blankets and steel plates over the grating, leaving only sufficient free area to apply the extinguishing fluid. If men enter the vault, they should have proper gas masks to protect against fumes and to give adequate oxygen for breathing. Vault should be thoroughly ventilated before starting repair work; this is especially important if carbon tetrachloride has been used to put out the fire. In addition, test of the atmosphere by lantern or other device should be made, in case carbon dioxide or dry compound giving low oxygen content is employed.

C. Manholes—For manhole fires same method and precautions are necessary. It is important also to guard against presence of combustible gas from nearby distribution mains or sewers, or vapor from gasoline leakage. In no case should men enter manholes until test with gas detector has shown the atmosphere to be safe for breathing and for use of tools.

Where city fire department may be called out for a vault or manhole fire, arrangement should be made for notification by department to company, before the firemen go into ac-

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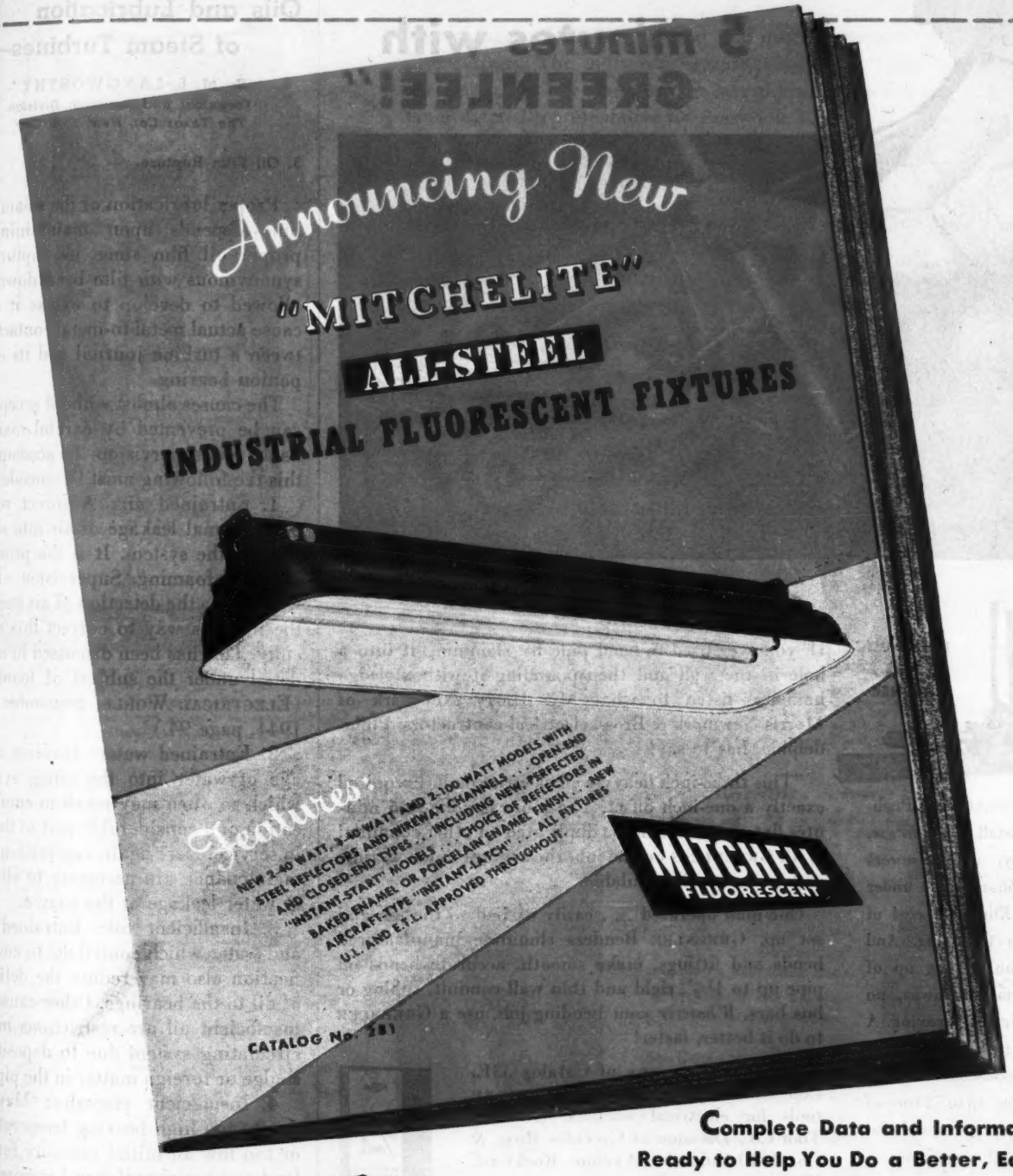
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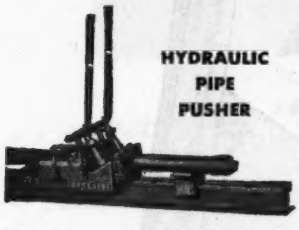

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Use GREENLEE Pipe Pushers to install pipe for gas, electricity, water, sewers and telephone cable under ground. Eliminate cost of extensive trenching. And there's no tearing up of pavements and lawns, no backfilling, no repaving. A portable tool, easy to carry and set up, GREENLEE Pushers develop up to 75 tons of pressure, have 6 speeds for varying soil conditions.

IF you ever tried to bend pipe by slamming it into a hole in the wall and then pounding it with a sledge hammer—listen to what Mr. Harry Newmark of Morris Newmark & Bros., electrical contractors, Philadelphia, has to say:

"This three-inch heavy wall electric conduit required exactly a one-inch offset. The job was done in 5 minutes flat . . . and could be duplicated on other conduits! With GREENLEES on the job, the savings in labor, time and money are incalculable."

One-man operated . . . easily carried to the job and set up, GREENLEE Benders eliminate manufactured bends and fittings, make smooth, accurate bends on pipe up to 4½", rigid and thin wall conduit, tubing or bus bars. *Whatever* your bending job, use a GREENLEE to do it better, faster!

Write for free copy of Catalog 33E. Contains complete facts on all GREENLEE tools for electrical workers. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1810 Columbia Avenue, Rockford, Illinois.

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tion. Company employees should direct the work, in order to extinguish fire with minimum damage to equipment and shortest possible outage.

Oils and Lubrication of Steam Turbines—III

By M. L. LANGWORTHY*
Technical and Research Division
The Texas Co., New York City

3. Oil Film Rupture.

Proper lubrication of the steam turbine depends upon maintaining a proper oil film since its rupture is synonymous with film breakdown; if allowed to develop to excess it may cause actual metal-to-metal contact between a turbine journal and its companion bearing.

The causes almost without exception can be prevented by careful maintenance and supervision. To accomplish this the following must be considered:

1. Entrained air: A direct result of abnormal leakage of air into some part of the system. It is the primary cause of foaming. Supervision which will lead to the detection of air leaks is the obvious way to correct this difficulty. This has been discussed in more detail under the subject of foaming. (ELECTRICAL WORLD, September 30, 1944, page 94.)

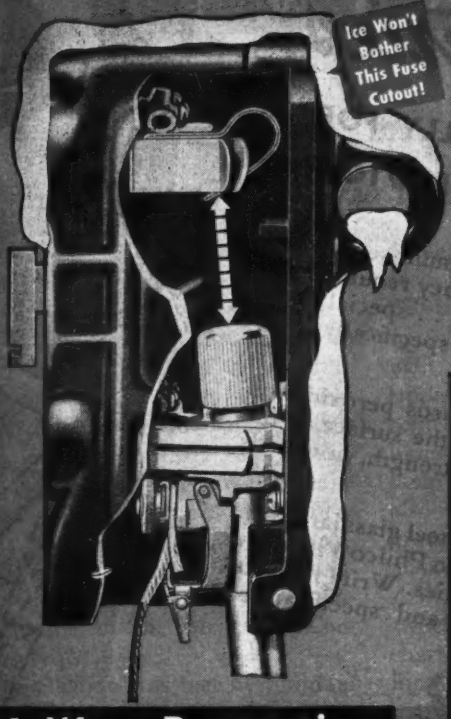
2. Entrained water: Involves leakage of water into the oiling system which so often may result in emulsification of a considerable part of the oil in service. Here again supervision and maintenance are necessary to eliminate water leakage at the source.

3. Insufficient oil: Entrained air and water which contribute to emulsification also may reduce the delivery of oil to the bearings. Other causes of insufficient oil are restrictions in the circulating system due to deposits of sludge or foreign matter in the piping.

4. Insufficient viscosity: May be due to too high bearing temperatures or too low an initial viscosity for the load and peripheral speed imposed on the bearing. This may develop during the periods of starting and stopping in some turbines, or where a rolling gear is installed to turn the turbine over at low speeds. On such occasions, the oil must have sufficient viscosity and wettability to insure maintenance of an adequate film between surfaces.

This series began in ELECTRICAL WORLD, September 30, 1944, page 93.

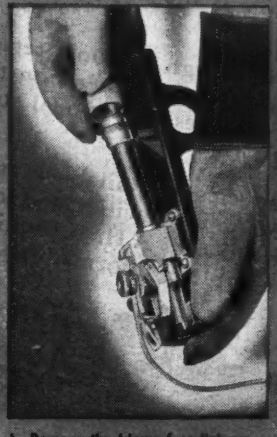
restore service *fast* with "PVD" [DISCONNECTING INDICATING] Fuse Cutouts



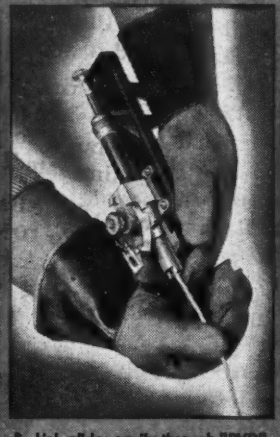
Blown fuses are quickly located, and quickly replaced, with "PVD" fuse cutouts. The indicating feature, easily seen from the ground, saves hunting. The design makes fast re-fusing safe and easy. Ask the Line Material representative for the whole story on the instant action and dependable protection of this outstanding fuse cutout, or write Line Material Company, Milwaukee 1, Wisconsin.

One Minute* Re-fusing

On-the-pole re-fusing of "PVD" fuse cutouts is a fast, safe operation, even with gloved hands; saves valuable time in restoring outages.



A. Remove the blown fuse link; unscrew fuse cartridge cap and pull out remaining section of the blown link. New fuse link can now be inserted into tube.



B. Link glides easily through "PVD" cartridge. Pull new link over flip-out device and around the bolt under the non-rotating washer of knurled thumb nut.

C. Tighten knurled nut, replace cap, and the job is done. Hook the "PVD" door back on its hinge and swing it shut in one continuous, easy movement.

4-Way Protection

1. *Protects Lines:* Link flip-out device assures instant separation of blown fuse link parts. "PVD" always operates as disconnecting cutout. Dropped position of cartridge assures large air gap between contacts—prevents re-establishing of arc or leakage.

2. *Protects Cutout:* Rugged Bakelite door always closed, even after link has blown. "PVD" contacts always sheltered from weather, dirt, corrosion. No burning of contacts, arc always clears inside the tube before contacts separate.

3. *Protects Lineman:* Door opens 180° for removal or insertion keeping live parts well away from lineman. Removal of cartridge with door assures safe, easy re-fusing on the pole, even with gloved hands.

4. *Protects Service:* "PVD" assures prompt, positive operation in all weather. Dropped cartridge signal—easily seen from the ground—saves hunting, spots trouble quickly. Six second re-fusing—cuts outage time.

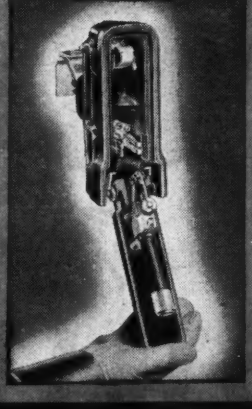
L-M "PVD" Fuse Cutouts available in these 4 sizes

5000 V. delta, 50 amp., 5000 V. delta, 100 amp.

7500/12,500 V. Gr.Y., 50 amp., 7500/12,500 V. Gr.Y., 100 amp.

There are many features that make "PVD" disconnecting fuse cutouts a sound investment. Talk to the L-M representative or write Line Material Company, Milwaukee 1, Wisconsin, for full information.

*Is "one minute" too slow? All right . . . here's 6-Second Re-fusing



Six seconds is plenty of time to re-fuse the "PVD" when the lineman carries a spare fused "PVD" door. He just opens and unhooks the old door and slams on the new fused door.

"PVD" doors are Bakelite, perfectly interchangeable—save time when restoring outages. Cutout operation is completely independent of door, which remains closed at all times to protect working parts. Ice on the door won't affect its operation.

LINE MATERIAL
FUSE CUTOUTS & FUSE LINKS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters · Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment

PHILCO
Floté Batteries

...ENGINEERED SPECIFICALLY FOR MODERN FULL FLOAT SERVICE!

IN a battery on full float service, maximum service life combined with high electrical efficiency requires special design . . . special construction . . . special grid metal. Philco Floté is the *only* battery specifically engineered to do this job!

Philco Floté grid design not only retards peroxidation by exposing a minimum of metal on the surface of the plate, but also provides exceptional strength. Low cells are eliminated!

Philco Floté Batteries are available in steel glass jars, from 10 A.H. to 1056 A.H. capacities; and in Philco Vitrabloc, from 240 A.H. to 660 A.H. capacities. Write for catalogs giving complete information and specifications.

Philco Corporation Storage Battery Division Trenton 7 New Jersey

Specify PHILCO TELEPHONE BATTERIES

Makers of the famous "PHILCO THIRTY"

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Infra-Red Oven Aids Material Handling

In order to handle greatly expanded production of light telephone sets, the Connecticut Telephone & Electric Co. of Division of Great American Industries, Meriden, was obliged to sub-contract most of the paint finishing of chassis and side plates. This work was done by three sub-contractors, requiring in one case a 135-mile round trip of trucking facilities three times per week. Beyond this relatively high expense, it was also difficult to maintain a steady flow of finished parts to the Meriden (Connecticut) plant.

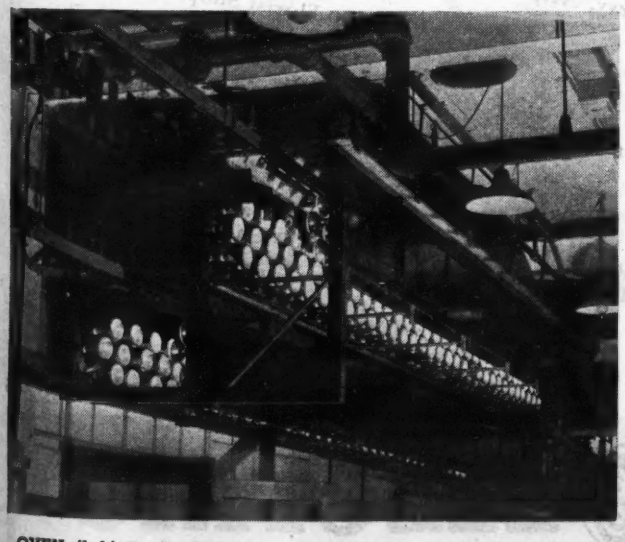
The situation was met by building an infra-red electric oven for use at Meriden, having a capacity of 240 pieces per hr. under a conveyor speed of 2 ft. per min. The oven was designed for a maximum speed of 8 ft. per min., to meet other possible service now and post-war. It is made in two similar sections, each 36 ft. long and supported from the ceiling to give an 8-ft. clearance above the factory floor, thus releasing space for other purposes when required. Each section contains 192 reflector type 250-watt heat lamps (48 kw. per section). Energy is supplied at 240 volts with each group of six lamps controlled by a switch mounted at a central board equipped with pilot lights to indicate when particular lamp groups are in operation and also the particular pattern of lamp groups in use from time to time. The position of lamps in the oven is shown on a chart at the top of the switchboard, lighted sections of the chart indicating those in use, as in illuminated diagrams employed in terminal train dispatching. The switching arrangement enables the amount of heat in the ovens to be changed at a moment's notice, and the framing of the oven is designed to permit a 5-in. maximum extension of the sides and also vertical spacing changes of lamps to be made as required.

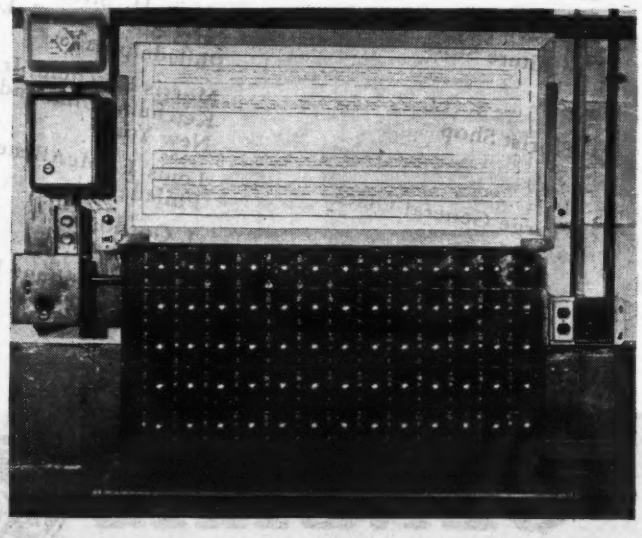
Slow-speed fans venting in ducts discharging to the roof provide an upward movement of air through the oven sections to offset the pull furnished by exhaust fans in the room. A ¼-hp. motor drives the conveyor, which has a total length of about 300 ft.

The oven illustrated in the lower left corner of this page shows the two similarly equipped sections served by the conveyor. One section is for the drying of the prime coat on telephone set parts and the other is for the baking of the finished coat.

The priming and finishing coats of synthetic enamel are sprayed upon the chasses and plates of the sets at a group of spray booths in a room near the oven. The conveyor forms a continuous loop from the spray booths to the baking section where the first coat is dried (in 12 minutes), thence back to the spray booths for the finish coat and returning to the second section of the oven for the final baking. The oven temperature is 340 deg. F. and about 12 minutes are required to bake the finish coat. Formerly 2 hrs. were required to bake the enamel in the outside ovens used in this work. A typical chassis weighs about 1 pound, now being made of steel, and as it passes through the oven it is slowly rotated by a wheel mounted on each hanger, and which rides against a track inside the oven. The side plates, weighing about 4 ounces each, are not rotated in passing through the oven. Wired-glass hatchways were built at the bottom of each oven to facilitate replacement of lamps.

Service is supplied by the Con-





OVEN (left) is divided into two similarly equipped sections served by a continuous conveyor, one section for drying prime coat and the other for baking the finish coat on telephone set parts. Switchboard (right) controlling pattern of infra-red lamp groups used carries pilot lamps illustrating set-up in operation at any particular time

THE LIGHTING INDUSTRY says...

So the GENERAL ELECTRIC lamp department has commissioned these additional Architects and Designers to work out Postwar Lighting Ideas

DONALD DESKEY

EDWIN H. SILVERMAN

ABRAHAM LEVY

THE JOBS	THE MEN	YOUR MARKET
Restaurant	Donald Deskey Donald Deskey Associates New York	153,000 Eating Places
Furniture Store	Edwin H. Silverman & Abraham Levy, Silverman & Levy, AIA Philadelphia	45,000 Furniture Stores
Florist Shop	Morris Ketchum, Jr. Ketchum, Gina and Sharp New York	16,000 Florist Shops
Large General Office	Louis E. McAllister Philadelphia	600,000,000 sq. ft. of Offices and Warehouse space
Group of Private Offices	J. Gordon Carr New York	197,000 Gas Stations 66,000 Garages
Service Station with Retail Shop	George Cooper Rudolph George Cooper Rudolph Asso. New York	

KEEP BUYING WAR BONDS

GENERAL ELECTRIC

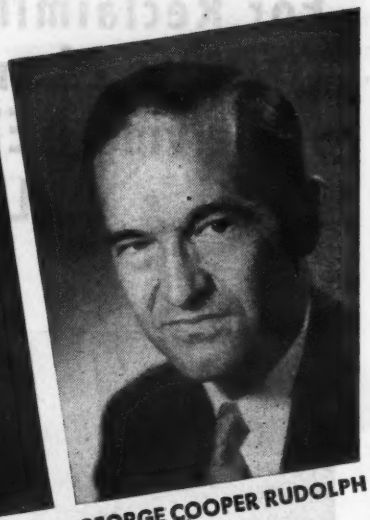
Hear the General Electric radio programs: "The G-E All-Girl Orchestra"

"MORE!"

MORRIS KETCHUM, JR.

LOUIS E. McALLISTER

J. GORDON CARR



GEORGE COOPER RUDOLPH

WHAT will postwar lighting be like? Early this year, the General Electric Lamp Department announced the commissioning of ten outstanding architects and designers to create new lighting ideas and fixtures suggestions for postwar stores, offices and homes.

Now, as a result of hundreds of favorable comments from members of the lighting industry, fixture manufacturers, architects and designers, General Electric has expanded its program by commissioning several more of the nation's best architects and designers . . . and still more will be announced later.

Each project has been assigned to a recognized authority in the field. And a glance at the opposite page will show you that each represents a large and profitable market that will be ready for immediate development as soon as materials are made available for remodeling and new construction.

Fixture manufacturers already are at work on new fixtures that incorporate design effects suggested in the first ten commissions. The results of the six additional jobs announced here likewise will be turned over to them for development.

The many comments already received, and the thousands of requests for booklets describing the projects, indicate that these postwar lighting ideas already are proving their merit to architects, designers, manufacturers of lighting equipment, to those who sell lighting, and those who use it.

Booklets now are available describing seven of the first ten commissions —two food stores, a drug store, two homes and two department stores. Others soon to be published include an office, a women's specialty store and a home.

Results of the six new commissions announced on these pages will be made available in the same way.

Please write to Div. 166-EW-J28, Nela Park, Cleveland 12, Ohio, if you would like a free copy of each booklet already published, or if you would like copies of the others when they are made available.

"TO MAKE G-E LAMPS
STAY BRIGHTER LONGER"
the constant aim of G-E Lamp Research

KEEP THE WAR BONDS YOU BUY

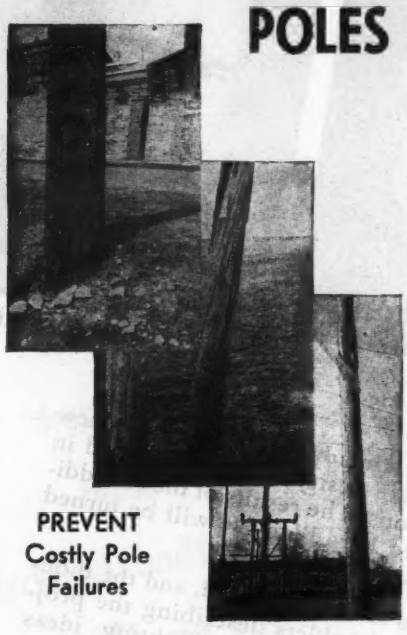
G-E MAZDA LAMPS

Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.

PERMATOX "A"

(A Straight Toxic Wood Preservative)

For Reclaiming OLD POLES and Preserving NEW POLES



PREVENT Costly Pole Failures

With the pole shortage becoming more critical, it is vitally necessary to get the utmost service from every pole in stock or installed on your lines.

PERMATOX "A" (5% pentachlorphenol in suitable petroleum solvents) affords an effective, economical preservative treatment . . for the control of decay, shell-rot and termite attack.

Specify it for poles, posts, cross-arms, ties, crossing planks, bridge timbers and other exposed construction. Soaking or pressure treatment insure adequate absorptions and deep penetration.

•

Furnished in Two Forms:—

DOWICIDE 7

Pentachlorphenol* crystals

PERMATOX "A"

5% Pentachlorphenol* in suitable petroleum solvents

*Manufactured by The Dow Chemical Company

Write for Bulletin

A. D. CHAPMAN & COMPANY, INC.

333 N. MICHIGAN AVE., CHICAGO 1, ILL.

Memphis Portland

New Orleans New York

necticut Light & Power Co., and in a typical run recently the maximum demand amounted to 66.2 kilowatts.

•

Lighting Salesmen Need Wiring Knowledge

A knowledge of wiring and code requirements and the ability to lay out a wiring job is placed high on the list of qualifications for commercial lighting salesmen by one Pacific Coast utility. In fact, the sales supervisor of this company says that it is easier to train a man with wiring and electrical knowledge to be a good lighting man than it is to take an illuminating engineer and try to teach him wiring.

This power company does not in any way usurp the functions of the consulting engineer or wiring contractor in making simple lighting and wiring layouts, but has found from many years of experience that there is quite a range of jobs where a customer would not consider the services of a consulting engineer or permit calling in a wiring contractor during the layout stage of the job. Further, he states that selling the necessary wiring job is often the real sales problem in putting in a good lighting job. Moreover, when the utility lighting specialist lays out the wiring job along with his lighting plan, then all wiremen called in to bid on the job are bidding on exactly the same specifications. This has proved an important factor as it instills confidence in the mind of the customer and prevents chiseling.

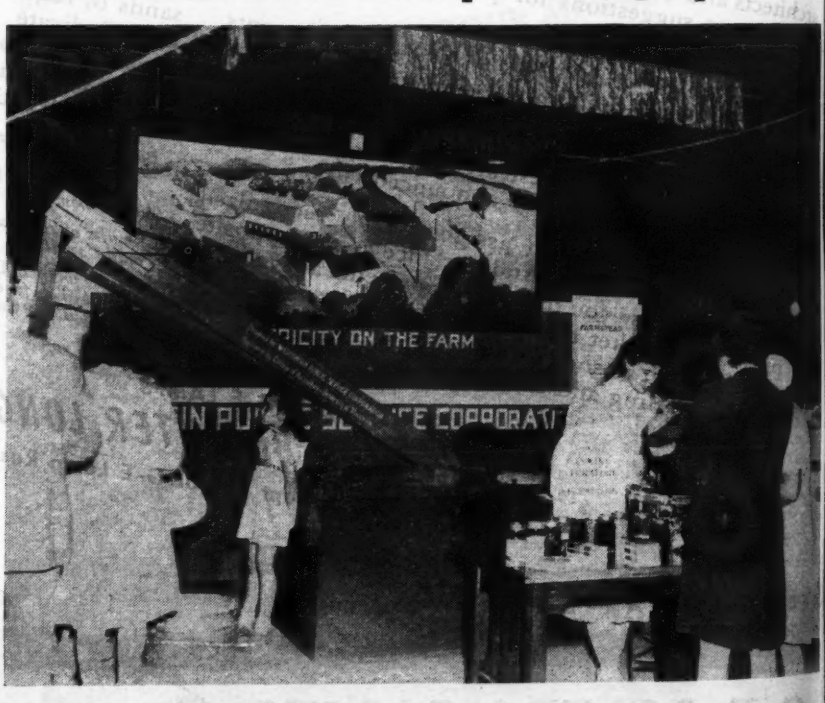
This utility plans an intensive postwar lighting sales program and is going to be more insistent than ever that good lighting men be equally as good when it comes to knowledge of code, wiring and proper layouts.

•

"Toaster" Principle Used in Curing Glue

Operating on the "toaster" principle of direct application of heat, a new glue curing device cuts down the time required to cure ammunition boxes from three hours to 15 minutes. The device and process are equally applicable to the assembly and fabrication of similar boxes made of plywood,

Manitowoc County Fair Display

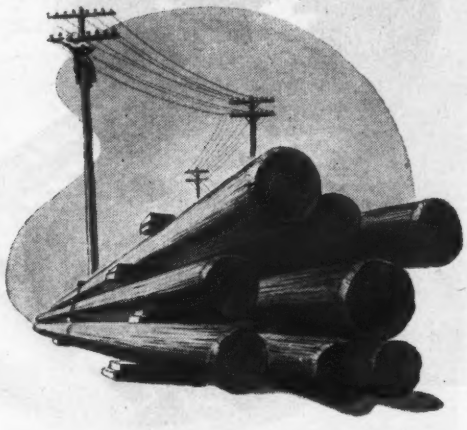


INTERESTED FAIRGOERS crowd around displays, above, of Wisconsin Public Service Corp. at Manitowoc County Fair. Even the poker-faced young lady appears absorbed, though non-commital. Displays were dairy water heater, home-made grain elevator, milk cooler, water system and chick brooder. At right Kathryn Heffernan, company home service instructor, passes out pressure canning information

DON'T PUT UP WITH TERMITES!

Mold and decay assume different forms under different conditions. Hence, varying treatments are required if the costly inroads of spoilage are to be prevented.

That is why there are seventeen related products in the Dowicide group—each is designed for a specific job—and each has proved itself in that assignment.



In the lumber industry, for example, there is a special Dowicide that protects wood against rot and termite attack for long periods of time. Application can be made by pressure impregnation or by tank soaking. After treatment, lumber is paintable, nonbleeding, and easily handled.

Whatever your problem in respect to decay, there is a Dowicide to help you. Don't put up with rot or termites—write the Dowicide Division for complete information.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland
Detroit • Chicago • St. Louis • Houston • San Francisco
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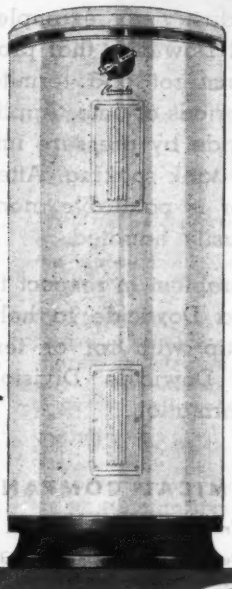
DOWICIDE

GERMICIDES AND FUNGICIDES

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

Get the Inside Story



THIS book reveals the INSIDE STORY about SMITHway *Permaglas* Electric Automatic Water Heaters. It tells the complete facts about *Permaglas* . . . the permanently fused blue glass lining that keeps SMITHway Water Heaters always free from rust...always sanitary...long enduring! It is a profit-builder . . . a good-will creator . . . a source of information about the outstanding quality advantages available only in SMITHway Water Heaters. Prepare now for sales by getting this interesting book!

HOT WATER BY wire

Have You Bought an Extra War Bond This Month?

SMITHway Permaglas GLASS LINED ELECTRIC WATER HEATERS

TRADE MARK REG U. S. PAT OFF

MAIL THIS COUPON TODAY!

A. O. Smith Corporation, Milwaukee 1, Wis.
I'd like to get the "inside story" of *Permaglas!* Please send me a copy.

Name.....Title.....

Company Name.....

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A. O. SMITH Corporation, Milwaukee 1, Wisconsin

Offices in: New York, Pittsburgh, Chicago, Tulsa, Houston, Dallas, Los Angeles, Seattle

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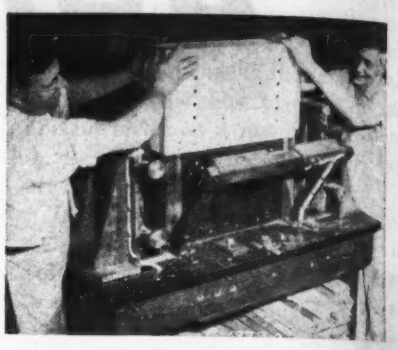
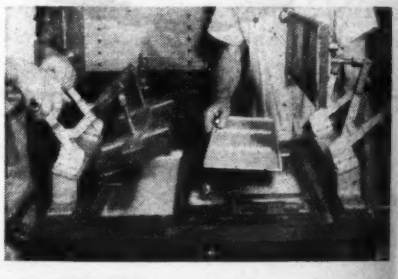
masonite, etc., wherein the attachment of one part to another is performed with resinous or synthetic glues which must be cured by the application of heat in the process of manufacture.



TOPS AND BOTTOMS of boxes are first cured in a device resembling a sandwich grill

In the process two jigs are employed. On one is assembled the tops and bottoms of the boxes. The bottom is then placed on the second jig where the four sides of the box have been assembled and angles glued to the corner, the device closed, clamps placed in position, and pressure screws turned forcing parts of the assembly



ENTIRE BOX is placed in a second toaster—this one resembles an automatic pop-up type

to be pressed solidly to the heat box. The assembly is cured for 15 minutes, and the operation is complete.

A 220-volt air strip heater is completely enclosed in refractory material, encased in a steel sheath and covered with masonite to provide 120 degree F. heat without scorching the wood. Heat is thermostatically controlled and is maintained at this point throughout the curing process.

The advantages of this process devised by P. J. Kraus, foreman of the wood shop, and W. H. Bankard, electrical department of tool design, Glenn L. Martin Co., Baltimore, Md., are low cost of heat application, saving of time, assembly can be observed during curing cycle and uniformity of glue after curing due to temperature control.

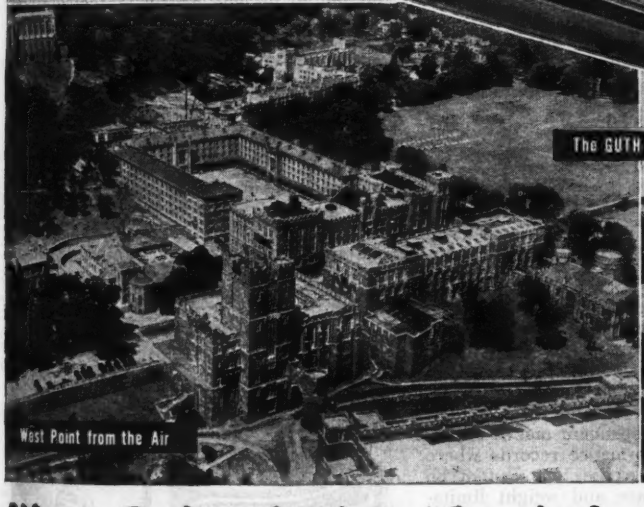
Saluting the GUTH *CADET

*THE FLUORESCENT LIGHTING FIXTURE INSTALLED IN THE UNITED STATES MILITARY ACADEMY AT WEST POINT

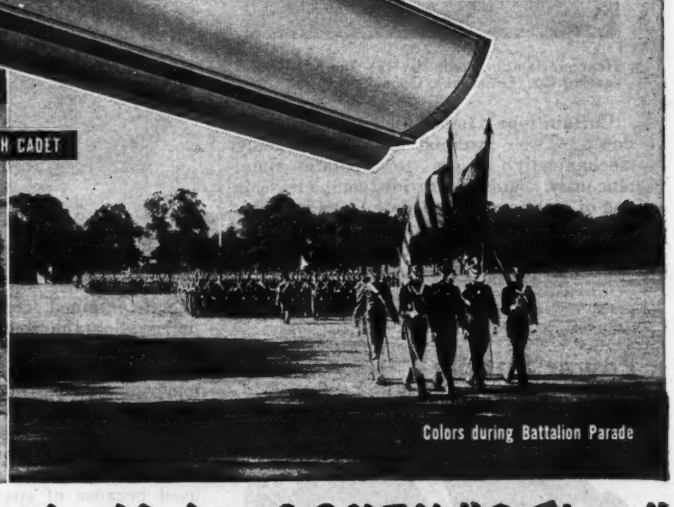
Cadets marching to Guard Mount

Cadet Chapel from De Russy Loop

The GUTH CADET



West Point from the Air



Colors during Battalion Parade

West Point Cadets Study by the Light of GUTH "Cadets"

THE study-areas at West Point Military Academy are now lighted by the Guth CADET the new semi-indirect type luminaire.

Forty-five Foot-Candles of uniform, glare-free, shadowless lighting is delivered on the study-desks. The illumination is evenly distributed throughout the area; there are no "Bright-spots"—all brightnesses are correlated. Reading visibility is excellent; writing with either pen or pencil is now effected without any direct or reflected glare. A 100% perfect *seeing-light* has been provided!

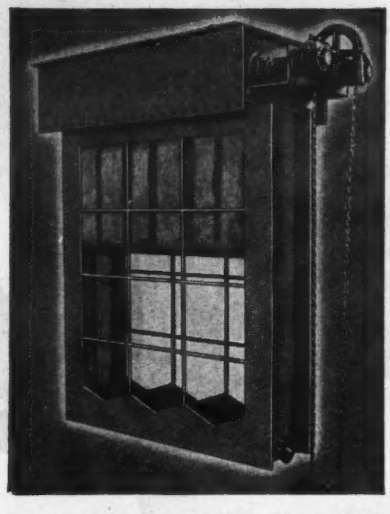
The new Guth CADET semi-indirect luminaire, is now Commercially available. Write for details.

THE EDWIN F. GUTH COMPANY
2615 Washington Ave. ST. LOUIS 3, MO.

LIKE THE WEST POINT CADET, THE GUTH CADET IS
Smart in Appearance *Efficient in Action* *Developed for Precision* *Dependable in Service*

NEW EQUIPMENT

Damper

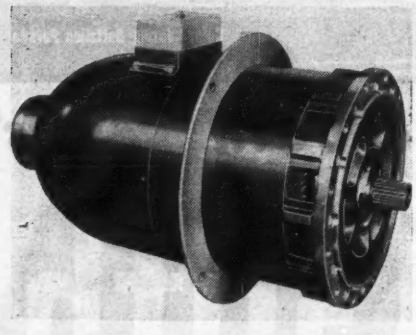


Heacon damper; type DVHR; **Thermix Engineering Co.**, Greenwich, Conn.

Curtain type damper used to regulate gas flows. Two curtains are tied together mechanically so as to operate simultaneously. Said to provide complete isolation of equipment for maintenance purposes. Banking losses are reported reduced and regulation of natural draft obtained.

•

Power Supply



Eclipse a.c. power supply systems; two models, 25 kva.; 18.75 kw., weight 49 lbs., rated output between 7,200-8,800 r.p.m. and 66.6 kva.; 50 kw., weight 129 lbs., rated output between 5400-6600 r.p.m.; **Bendix Aviation Corp.**, Teterboro, N. J.

A.C. power supply system consisting of variable frequency generator and a carbon pile voltage regulator for either constant or variable frequency. Incorporated exciter and brushes designed for service at high altitudes.

Insulation

Gerac 200; inorganic; 200 deg. C operating temp.; class C; **Sprague Electric Co.**, North Adams, Mass.

Characteristics are based on wire having a coating of ¼ mil thickness. 1. Max. stable temperature for continuous operation 200 deg. C. 2. Voltage breakdown between two wires of a twisted pair four inches long at standard condition. (25 deg. C), at 95 percent humidity and a hot condition of 200 deg. C. 300 volts a.c. Leakage at 95 percent humidity 100,000 megohms. Stated to have good winding characteristics and applicable to copper wire sizes up to 21 A.W.G. and nickel wire up to 28 A.W.G.

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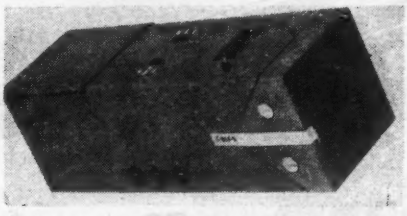
Oscillograph



Miniature six-element oscillograph; type P M-17-A1; case 4½ in. by 4½ in. by 14 in.; wt. 10 lb.; **General Electric Co.**, Schenectady 5, N. Y.

Self-contained, compact, permanent-magnet oscillograph consists of three principal systems: 1, optical system; 2, six parallel galvanometer channels; 3, photosensitive material transporting mechanism with internal motor and removable film holder. It is said that the instrument makes it possible to obtain performance records where the larger general-purpose type cannot be used because of space and weight limitations.

•

Relays

Accumulative time delay relay; type TD 8; **R. W. Cramer Co. Inc.**, Centerbrook, Conn.

Relay which is stated to open the main control circuit in case an added overload period exceeds a predetermined time interval. It is reported to be especially designed to add the time interval of momentary surges occurring in quick succession.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Filling Compound

Type S-182 filling compound; dries overnight at 60-70 deg. C.; hard in one to six hours when baked at 105-110 deg. C.; **Sterling Varnish Co.**, Haysville, Pa.

Compound is supplied in two separate parts—S-182A, a viscous liquid, and S-182E of low viscosity, which are mixed prior to use. Mixture said to retain sufficient liquidity for pouring for a period of four to five hours. The compound, although heavy, is said to penetrate into small interstices. Said to have high dielectric strength, low coefficient of expansion, to be water resistant and oilproof. Stated to withstand temperatures up to 200 deg. C. without resoftening and not to become brittle at temperatures as low as 60 deg. C.

•

Shims

Adjusting shims; thicknesses 0.001 to 0.030 in.; **Industrial Products Suppliers**, 2 Broadway, New York 4, N. Y.

Artus shims for Timken cup adjusted and cone adjusted roller bearings are said to be non-hygroscopic and impervious to oils and greases. Said to be applicable where temperatures do not exceed 175 deg. F.

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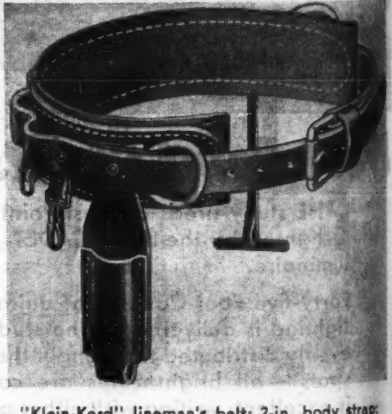
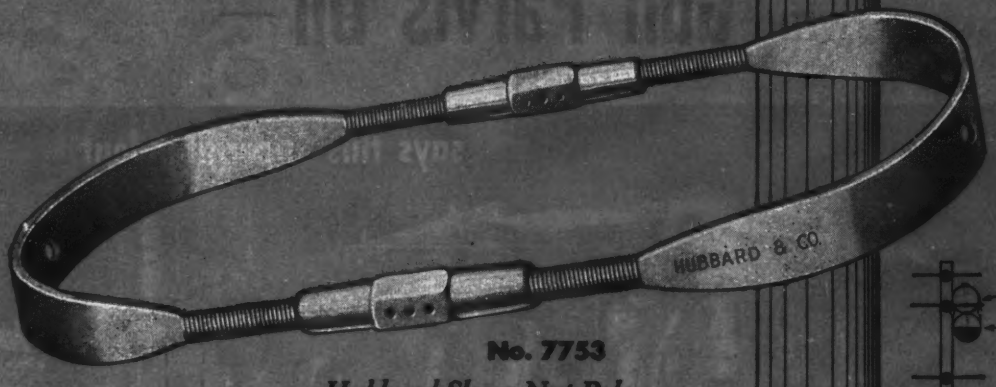
Lineman's Belt



"Klein-Kord" lineman's belt; 2-in. body strap; 4½-in. lining on 4-in. belt; "D" ring solid steel drop forging; **Mathias Klein & Sons**, Chicago, Ill.

Lineman's belt made of material called Klein-Kord. Said to consist of specially woven long staple cotton laid in rubber and vulcanized. Said to be water-proof, to have high tensile strength and to be flexible. It is stated that holes may be

"Making Big Ones out of Little Ones"



No. 7753

Hubbard Sleeve-Nut Pole Reinforcing Bands for Stubbing Poles

With most of our lumbermen handling knives and walnut gun stocks instead of axes and cedar, pole replacements are somewhat of a problem in many localities. Add to this, the difficulties of shipping and handling heavy materials amidst war time traffic congestion and the result is a scarcity of poles for some of our Utility Companies.

The problem is being partially solved on a temporary basis by pole stubbing. Discarded poles with rotted bottoms but firm wood above the original ground line are used as stubs. After cutting away the rotted butt and treating, stubs are set alongside the pole which is in service but in need of replacement. Hubbard Sleeve-Nut Bands are installed as shown in the diagrams.

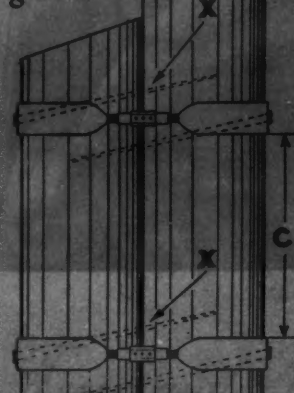
Given a solid setting for the stub, the resultant structure will hold to the breaking strength of the average pole, as illustrated by the accompanying photo of a test.

Stubbing "Across the Line"

(A)

Stubbing "On the Line"

(B)



Diagrams above show the usual methods of stubbing which are (A) "across the line" and (B) the alternative method, "on the line". Dowels (X) may be used in either case but are especially recommended for "on the line" installations. Separation of bands (C) is 36" to 50" depending on potential line strain and pole height.

Testing a Stubbing Band Assembly

Above pole broke at 48,000 foot pounds without damage to the Hubbard Sleeve-Nut Stubbing Band. Pull was applied "in line" with conductors, stubbing was "across the line"; Dowels were used.

HUBBARD AND COMPANY

PITTSBURGH · OAKLAND · CALIFORNIA · CHICAGO

"FOR 23 YEARS THIS ENGINE HAS DELIVERED EFFICIENT, DEPENDABLE PERFORMANCE WITH Gulf Parvis Oil —"

says this Superintendent

Actual photo of a Gulf Service Engineer consulting with Superintendent on Diesel engine lubrication.

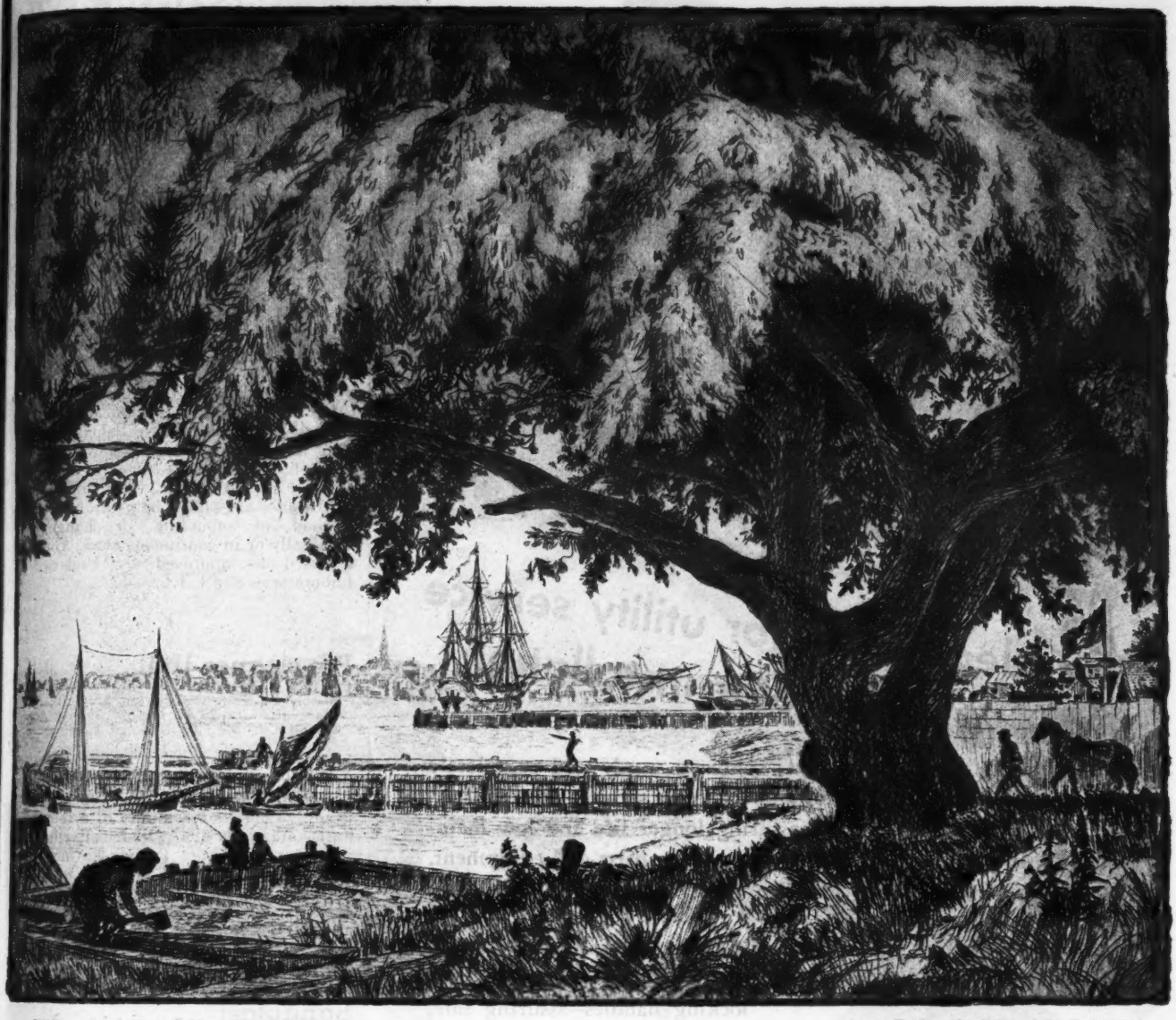
"This engine has operated efficiently and dependably since it was installed in 1921—and the high quality of Gulf Parvis Oil has been an important factor in this outstanding performance," says the Superintendent of the Mexia, Texas municipal power plant. "Proper lubrication has paid us big dividends for 23 years—our maintenance costs have been remarkably low, and we have a record of uninterrupted service to our customers."

There are good reasons for the outstanding performance of Gulf Parvis Oil in hundreds of Diesel engines. This higher quality lubricant is manufactured from selected crude oils by the most modern refining methods. And built into it is superior lubricating value and longer life—two assets that insure less wear, lower maintenance costs, and efficient, dependable Diesel operation.

If you are not one of the hundreds of enthusiastic users of Gulf Parvis Oil, it will pay you to investigate—call in a Gulf Lubrication Service Engineer and ask him to recommend the proper grade to fit your particular requirements. Write, wire, or phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH 30, PA.



William Penn Treaty Elm, Philadelphia — *Etching by Edward C. Smith, '44*

. . . About Public Utilities, Trees, and Post-War

Tree trimming is going to be featured in the post-war era of public utilities. An important survey of the utility industry reveals this.

The survey, reported by Electrical World, shows a majority of the industry expects increases or shifts in loads after the war. Shifts that will necessitate substantial reinforcements of urban and suburban distribution systems.

Tree trimming was viewed by the industry in this survey as foremost among the coming practices to promote reliability of power service. Tree trimming to keep the branches clear of the power lines . . . to eliminate interference of service . . . to preserve the trees, their life, their shapes. For some time, the importance of correctly trimming trees has been realized, but now it is regarded a significant item worthy of nation-wide interest.

The Asplundh Tree Company has handled tree trimming for many utilities throughout the country. After the war it will extend its service to all Power companies desiring its specialized work.

Post-war expansion of Asplundh will re-employ its many men returning from the armed forces to carry on its work throughout the United States.

ASPLUNDH TREE EXPERT COMPANY
JENKINTOWN • PENNSYLVANIA

BRANCH OFFICES: Chicago, Ill.; Binghamton, N. Y.; Columbus, Ohio; Tulsa, Oklahoma; Alexandria, Va.; Washington, D. C.; Baltimore, Md.; Charlotte, N. C.; River Edge, N. J.; New Castle, Pa.; Pittsburgh, Pa.; Omaha, Nebr.

The ideal body for utility service and meter installation

● A "rolling workshop"—light, compact, sturdy and completely equipped, designed for efficient and economic service. All-steel construction—welded throughout—assuring longer life and low maintenance. Ample compartment space for tools, parts and equipment. Large, easily-accessible space for carrying meters, appliances, wire or other bulky material.

MODEL 190
for the ½ and 1 ton chassis

Body is 90" long—with standard and optional features similar to those on model 175.

All doors have Baker Weather-tight construction with key-locking handles—assuring safe, dry, dust-free compartments. Optional equipment includes sliding steel roof, partition trays, padded meter trays, pipe vise and bracket, and ladder brackets. Overall size 75" long, 69¾" wide, 41" high.

★ ★ ★

Write for Bulletin No. 50 for complete description of model 175, and Bulletin No. 45 for model 190.

THE BAKER RAULANG COMPANY
UTILITY BODY DIVISION
1282 West 80th Street • Cleveland, Ohio

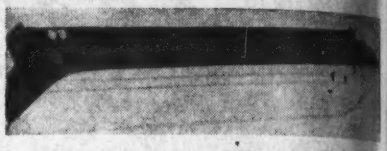
Dependable AS THE SERVICE THEY HELP TO MAINTAIN

Baker BODIES AND EQUIPMENT FOR EVERY UTILITY PURPOSE

punched in the strap without danger of ripping under strain. This is said to permit the use of tongue-type buckle.

•

Industrial Fixture



"Mitchelite" all-steel industrial fixture; open and closed-end reflectors; pf. 90 percent; 110-125 v. 60 c.; **Mitchell Manufacturing Co.**, Chicago, Ill.

Units include 2-40 watt, 3-40 watt and 2-100 watt models, with choice of open-end or closed-end reflectors, in baked enamel or porcelain enamel finish. Wireway channels and reflectors are constructed of heavy gage steel. Finished in battleship gray outside. Accessories are said to be provided for every method of mounting or hanging—individually or in continuous rows. Units are reported as approved by Underwriters' Laboratories and E.T.L.

•

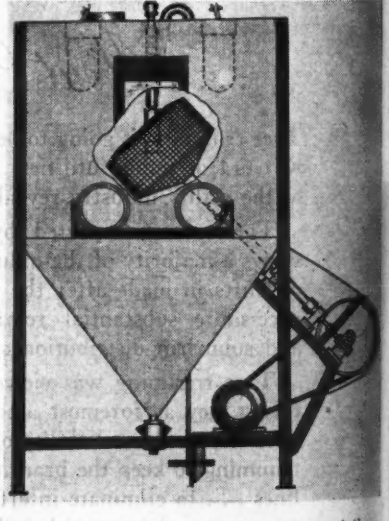
Pre-cleaner Unit

Pre-cleaner unit; storage bin 2 cu. ft.; floor space 18 in. x 25 in.; height 30 in.; **Aget-Detroit Co.**, 602 First National Building; Ann Arbor, Mich.

Pre-cleaner unit to be used in conjunction with Model 600 Dustkop dust collector. Consists essentially of a removable dust storage bin and cylindrical centrifugal separator with inlet flanges having single or double sleeves to connect with dust source. Storage bin said to have ample capacity for light or medium duty type of sawing, sanding or planer work.

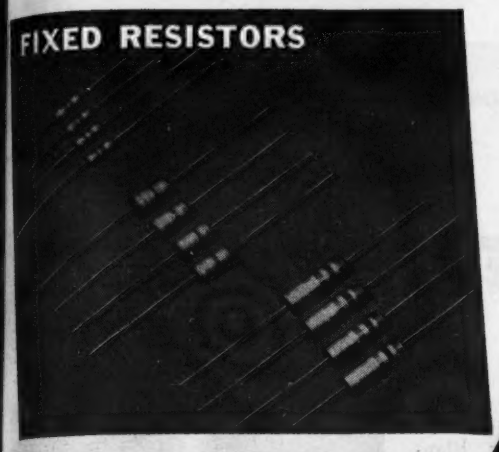
•

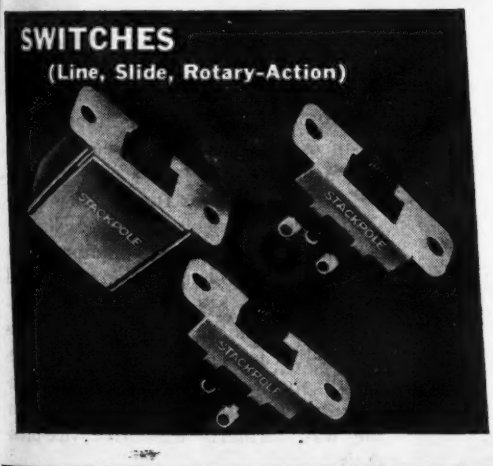
Sandblast

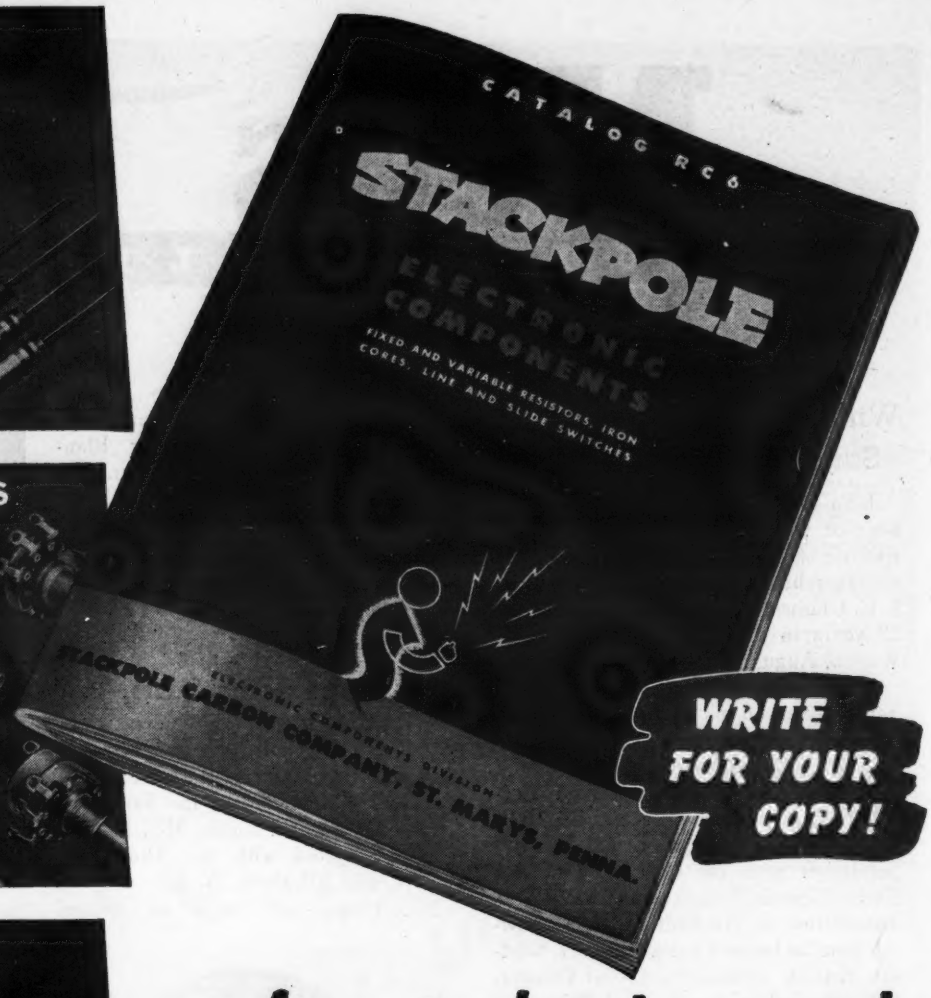


Sand blast cabinet; stationary nozzle; rotating basket or tumbling barrel types; **Leiman Bros. Inc.**, 113-76 Christie St., Newark 5, N. J.

Combination of sandblast cabinet with stationary nozzle and rotating basket or tumbling barrel to clean the surface of metals of rust, scale, etc. in preparation for electro-plating, enameling or other types of finishing.






CATALOG RC6
STACKPOLE
ELECTRONIC COMPONENTS
FIXED AND VARIABLE RESISTORS, IRON CORES, LINE AND SLIDE SWITCHES
STACKPOLE CARBON COMPANY, ST. MARYS, PENNA.

WRITE FOR YOUR COPY!

...for today's needs ...for post-war planning

USE this new 1944 Stackpole Electronic Components catalog as your guide to up-to-the-minute Fixed or Variable Resistors; Iron Cores; and inexpensive line, slide, or rotary-action Switches. In addition to *complete* information and dimension diagrams on the components, you'll find data pages and charts that will prove mighty handy in your daily work. Please ask for Catalog RC6.

STACKPOLE CARBON COMPANY, ST. MARYS, PA.

STACKPOLE

BRUSHES FOR ALL ELECTRICAL ROTATING EQUIPMENT • CONTACTS
WELDING RODS, ELECTRODES, AND PLATES • CARBON PIPE • BRAZING BLOCKS • RHEOSTAT PLATES & DISCS
CARBON REGULATOR DISCS • PACKING, PISTON, & SEAL RINGS • SINTERED IRON COMPONENTS, ETC.

NEWS ABOUT PEOPLE

Winnipeg Hydro Names Sanger General Manager

John W. Sanger, formerly chief engineer of the City of Winnipeg Hydro-Electric System, has taken over the managership of this utility, succeeding J. G. Glassco, who retired recently after 32 years in that position (ELECTRICAL WORLD, August 12, 1944, page 16).

A native of Bristol, England, Mr. Sanger received his engineering instruction at Faraday House, London, England. After graduating, he associated himself in 1906 with the Midland Electric Power Co., Staffordshire, England, as district superintendent. His first appointment with the City of Winnipeg Hydro-Electric System came in 1912, as distribution superintendent. The following year he became sales engineer, western district, of Siemens Co. of Canada, but returned to the City of Winnipeg Hydro-Electric System in 1915 as power house superintendent. Eight years later, he was appointed chief engineer of the utility, the position he held until his appointment as general manager.

Mr. Sanger has accomplished much outstanding work, including design and construction of the City of Winnipeg steam heating system and steam standby plant, and design and construction of Slave Falls power plant on the Winnipeg River. Mr. Sanger is one of a group appointed to report on farm electrification for the Province of Manitoba. In addition he also serves on the Province of Manitoba Advisory Committee on Co-ordination of Post-War Planning. He holds membership in the American Institute of Electrical Engineers, the Engineering Institute of Canada and from 1931 to 1944, he served as vice-chairman of the Manitoba Power Commission.

•

J. B. Clapp Joins Staff of Thomas & Betts Co.

Jerome B. Clapp, for the past twelve years sales engineer for the James R. Kearney Corp., St. Louis, Mo., has become associated with the Thomas & Betts Co. of Elizabeth, N. J.

Mr. Clapp will serve as special representative in the utility field, where a broader line of Thomas & Betts' products is contemplated. He will work out of the company headquarter's office in Elizabeth.

•

▶ HELEN L. KIRTLAND has been appointed home service and home lighting director of the New Jersey Power & Light Co., Dover, N. J. Miss Kirtland has had sixteen years experience in home service and home lighting work, previous connections including New York State Electric & Gas Corp., Rochester Gas & Electric Corp. and for the past five years, Republic Light, Heat & Power Co., Buffalo, N. Y.

Rumsey Electric Elects J. B. Harris, Jr., President

To fill the vacancy caused by the death of its president, Eugene A. Rumsey, in July, the board of directors of the Rumsey Electric Co., Philadelphia, elected the following officers: George A. Rumsey, chairman of the board; J. Baker Harris, Jr., president; George S. Trimble, secretary and treasurer; B. T. Hare, vice-president and T. M. Gottschalk, assistant secretary and assistant treasurer.

Wanamaker-Underwood

J. B. Harris, Jr.

George A. Rumsey, who with Eugene A. Rumsey, his brother, founded the business, was formerly secretary and treasurer.

J. Baker Harris, Jr., the new president, was formerly vice-president in charge of the electrical equipment department, representing engineering and sales of Delta Star high tension equipment, Sangamo meters, Lapp Insulators and Allis-Chalmers transformers, Pittsburgh works, as well as other prominent manufacturers. George S. Trimble was formerly executive vice-president.

•

▶ MARK ELDREDGE, who joined the power division of WPB early in 1942 to handle power supply for war industries, has been made chief of the electrical engineering section of the Defense Plant Corporation's Surplus War Property Division. Before joining the old National Defense Advisory Commission in August, 1940, Mr. Eldredge had been director of the electric division of the Memphis Light, Water and Gas Division. For 15 years previous to its acquisition by the city, he had served as chief engineer of the Memphis Power & Light Co. With NDAC, he was assigned to help army and navy contractors who were building new plants. Later, he transferred to the

PLAN NOW
FOR TRAFFIC SAFETY LIGHTING

Above:
Main Street,
Hudson, Michigan

PROGRESSIVE COMMUNITIES are now studying the problems of post-war safety, particularly ways and means of reducing nighttime hazards . . . Good Street Lighting assures marked reduction in night accidents, facilitates traffic flow with safety, provides convenience and protection.

USE HOLOPHANE REFRACTORS for the most effective, permanent, and economical lighting of your streets and highways . . . There is a Refractor for every type of street—for every size of lamp. Refractors deliver more light, properly distributed and at wider spacings. Holophane Refractors are the only means to efficient light control, increased visibility, and reduced maintenance costs.

ARMY E NAVY

Holophane

HOLOPHANE COMPANY, INC.... *Lighting Authorities Since 1898*

342 MADISON AVENUE, NEW YORK 17 • Holophane Co., Ltd., 385 Yonge St., Toronto, Can.

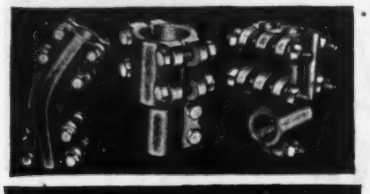
"When you need ANY Power Connector—

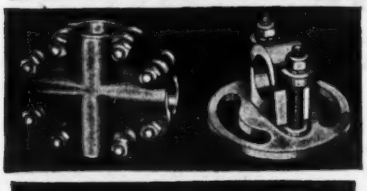
—see the COMPLETE line"

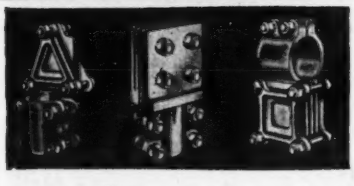
Probably the exact Power Connector you want is shown in the Penn-Union Catalog.

You will find Tee, Stud and End Connectors, Bus Supports, Terminals, Elbow and Cross Connectors, Couplers and Reducers—

—each in a wide range of sizes, up to the largest. Here are a few of the many types:







Also the most complete line of Cable Taps, Straight and Parallel Connectors, Lugs, Grounding Clamps—every good type.

Leading utilities, industrials, electrical manufacturers and contractors have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.* Write for Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

Office of Production Management expediting steel for the ship programs, before joining the power division.

•

▶ KIMBBALL I. JACK, has been appointed by the Washington Water Power Co. to head a newly organized personnel department and is responsible for employment, wage and salary control, training and education, safety and health, personal security and activities of employees. He will continue to supervise company advertising in addition to his new assignment. Mr. Jack went to Spokane in 1939 to form an advertising and promotion department for Washington Water Power Co. He was previously advertising manager for the Utah Power & Light Co., Salt Lake City. He is a national director of the Public Utilities Advertising Association.

•

G. A. Strain Retires As Utility Vice-President

Gray A. Strain, a vice-president of the New York State Electric & Gas Corp., retired last month after having rounded out fifty years of service in the electrical industry. He had completed a thirty-eight year connection with the New York state utility at the time of his retirement. Mr. Strain was the guest of honor at a dinner given by the company on September 19 at the Victoria Hotel in Ithaca.

Mr. Strain had more than ten years experience in the gas industry, before

affiliating himself with the J. G. White Management Corp., predecessor of the Associated Gas & Electric Co. in 1906, as general superintendent of the gas plant and gas operations in Helena, Mont., remaining there until 1918 when he was transferred to Ithaca as general superintendent of what then was the New York State Gas & Electric Corp. He was in charge of electric and gas operations in Ithaca, Cortland, Oneonta,

YOU CATCH trouble before it catches you —if you own a HYPOT

HYPOT High Voltage Insulation Breakdown Tester. Model 406 illustrated. 3 KVA 0-3000 volt secondary, 115 volt 60 cycle primary, 500 milliampere secondary circuit. Complete with burning ground circuits and rubber tired wheels. 20' high voltage test leads, 50' input leads, 50' ground leads.

THE INSTRUMENT THAT WILL FOREWARN YOU OF PROBABLE ELECTRICAL FAILURE

With a HYPOT you can quickly locate insulation faults that would burn out in service

HYPOT

has ample capacity for all testing. Quick, easy control from 0 to maximum voltage. 5 models available for all services.

EASILY PORTABLE UNIT

HYPOT Model 406 is equipped with rubber-tired wheels for easy moving. Complete safety to operator and equipment. Prompt delivery.

Forewarned is forearmed— Keep a HYPOT on hand at all times

WRITE FOR COMPLETE FACTS AND DATA—TODAY!

ASSOCIATED RESEARCH, Incorporated

221-C SOUTH GREEN STREET
CHICAGO 7, ILL.

Not Time Yet for Paper Capers!

Sure, the news is good — terrific, in fact. But don't let that give you the idea that America's paper shortage is over. More paper than ever is needed now to wrap supplies for our armies as they drive toward their goal. There's still a manpower shortage in the pulp industry.

So, you've still got to watch your company's use of paper with the hawk eye of a paper miser.

You've still got to use your ingenuity and that of your staff to find even more ways to *use less paper.*

All material made of paper and paperboard still must be cut to the bone. Eliminate whatever you can until complete and final victory ends the paper pinch.

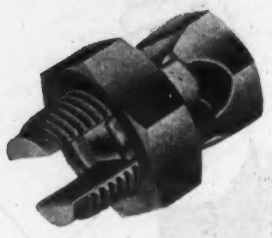
The baling of wastepaper and sending it to the reprocessing plant is still of prime importance.

Remember—
PAPER IS WAR POWER

USE LESS PAPER—SAVE ALL WASTEPAPER

This advertisement contributed by this publication and prepared by the War Advertising Council in cooperation with the War Production Board and the Office of War Information.

RELIABLE Connectors



Save Time by using solderless connectors with accurately fitting precision threads which insure easy, permanent installations.

Save Copper by using these connectors which are good as new after being salvaged.

EASY TO INSTALL
LOW IN COST

Reliable
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO 12 ILLINOIS

Norwich and Liberty districts which then comprised the company.

Made a vice-president in 1922, he had part from then until the present in all major developments of the company. In many instances he negotiated for the purchase of companies which later merged into the present company —New York State Electric & Gas Corp. For the last several years he has specialized in regulatory matters, supervising rate, franchise, rural electrification and other business in the company's negotiations with the New York Public Service Commission.

•

New Hampshire Utility Forms New Department

Effective November 1, a new department under the supervision of a general commercial manager will be added to the general office staff of the Public Service Co. of New Hampshire in Manchester, A. R. Schiller, president and general manager, states that all sales of electricity for industrial, commercial and domestic purposes will be conducted by this branch of the organization, which will be headed by Merton T. Carter, now manager of the Nashua and Milford districts. Mr. Carter joined the company in 1928 as a salesman at Milford, and in 1930 became assistant district manager at Lancaster, and district manager in 1937, going to Keene as district manager in 1940. He assumed his Nashua post in 1943 and last August was also placed in charge of the Milford area.

Marshall W. Gilchrist, manager of the company's northern division at Lancaster since 1940, has been appointed manager of the Nashua and Milford districts. George E. Hunter, Jr., since 1943 assistant to the manager at Lancaster, has been made northern division manager, succeeding Mr. Gilchrist. His duties will also include the Berlin district, lately added to the northern division and formerly a part of the Twin State Gas & Electric system. Mr. Hunter joined the company in 1937. J. L. Ordway will continue as district manager in Berlin, reporting to Mr. Hunter. R. E. Donahue, superintendent at Lisbon, and connected with the company since 1934, becomes district manager there, under Mr. Hunter.

•

▶ MINOR C. SUMNERS, auditor for the Arkansas Power & Light Co., has been named chief acountant of the Arkansas Department of Public Utilities, succeeding J. D. WALKER, JR., who resigned to enter the accounting business for himself. Mr. Sumners, a native of Arkansas, has been with Arkansas Power & Light since 1929, except for a brief period

SOLID SHANK
The Strongest Known Shovel
• The Sturdee Solid Shank Telegraph Shovel is forged in one piece from a solid bar of steel.
It is exclusive in construction —the strongest shovel known.
America's largest shovel users —railroads, mills, mines—specify, use and universally acclaim Solid Shank as first in utility, service life and economy.
Every light, power, and communications user who has tested this shovel now standardizes on Sturdee Solid Shank—they will have no other.
Reduced costs will follow if you specify Sturdee Solid Shank for all telegraph shovels.
STURDEETOOLS
a TRUE TEMPER PRODUCT
Cross-section at right illustrates the solid shank, one piece construction of Sturdee Telegraph Shovels. 22 inch, straight handle socket. 13 gauge, heat treated blade. XX grade hickory or ash handle, sanded and waxed. Length 6 feet to 12 feet.
Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

This announcement is not an offer to sell or a solicitation of an offer to buy these securities. The offering is made only by the Prospectus.

Commonwealth Edison Company

$180,000,000

(of which $155,000,000 are to be publicly offered)

First Mortgage 3% Bonds, Series L

Dated August 1, 1944 — Due February 1, 1977

Price 104¼% and accrued interest

This Prospectus may be obtained in any state in which this announcement is circulated from only such of the undersigned and other dealers as may lawfully offer these securities in such state.

HALSEY, STUART & CO. INC.

HARRIMAN RIPLEY & CO. INCORPORATED — THE FIRST BOSTON CORPORATION — GLORE, FORGAN & CO.

HARRIS, HALL & COMPANY (INCORPORATED) — LEE HIGGINSON CORPORATION — BLYTH & CO., INC.

GOLDMAN, SACHS & CO. — KIDDER, PEABODY & CO. — LEHMAN BROTHERS

MELLON SECURITIES CORPORATION — F. S. MOSELEY & CO.

SMITH, BARNEY & CO. — A. G. BECKER & CO. INCORPORATED — CENTRAL REPUBLIC COMPANY (INCORPORATED)

ALEX. BROWN & SONS — CLARK, DODGE & CO. — HORNBLOWER & WEEKS

STONE & WEBSTER AND BLODGETT INCORPORATED — UNION SECURITIES CORPORATION

October 18, 1944

POST-WAR PLANNERS, LOOK AT THE

2100 LINE

COMBINATION METER AND CURRENT **TRANSFORMER CABINETS**

30" High, 18" Wide 8½" Deep. IDEAL FOR OUTDOOR OR INDOOR USE

● Available now for Type A meters. Meter panel with Test Block bridge removable as a unit. Allows meter and test switch to be wired in laboratory. A universal low cost cabinet for the modern meter department, accommodates one or two meters.

METER DEVICES COMPANY - CANTON OHIO

ILSCO
Electrical Connectors

YOUR POST-WAR PLANS

undoubtedly are in formation now. For better results and lower costs Ilsco Products are indispensable. Learn the newest developments in

ELECTRICAL CONNECTORS

• • •

FABRICATED COPPER TUBE PARTS

• • •

Get our Catalog. Ask our Engineers to help in your problems.

Please rush us 32-page illustrated catalog.

Name .....

Firm Name .....

Address .....

ILSCO COPPER TUBE & PRODUCTS, Inc. CINCINNATI OHIO

when he was in business for himself. He has devoted most of his time during the last two years to working on the reclassification of accounts studies of the utility in conformance with a Federal Power Commission order requiring the company to make certain accounting changes in its books.

► DON ALFORD has been appointed residential sales manager of the Public Service Co. of Indiana to head the new program of load building through dealer cooperation. For years Mr. Alford has been in charge of the gas space heating sales program.

► LIEUT.-COL. ATHERTON THOMAS has been appointed assistant personnel director of the Consolidated Edison Co., with the assignment of fitting Consolidated Edison employees discharged from military service into jobs with special consideration of their experience, new skills and knowledge gained during the war. Colonel Thomas is expected to be released from the Army so that he can take up his duties with the company on November 1. He served as engineer of forecasts and statistics for the company before entering military service in 1942.

► G. H. SMITH, who resigned last July as general sales manager of the Edison General Electric Appliance Co., Chicago, has been named sales manager of the radio and phonograph division of the Magnavox Co., Fort Wayne, Ind.

► JAMES C. DELONG, formerly advertising director of the General Cable Corp., has been appointed director of advertising for Transcontinental & Western Air, Inc., with headquarters in Kansas City, Mo.

► JOHN F. GILLIGAN has been appointed advertising manager of Philco Corp. Mr. Gilligan joined Philco in 1922 and has served in important positions in the sales, advertising and order departments. During the war emergency, he has been serving as manager of the priorities division.

► P. C. SOWERSBY, formerly assistant advertising manager for General Electric's lamp department at Nela Park, Cleveland, and more recently a member of the company's Michigan District, Detroit, has been appointed to the position of sales promotion manager of the lamp department's Midland sales district, Chicago. He succeeds HUGH SMITH, who recently left to serve as sales promotion manager for Research Institute of America, New York.

Westinghouse Announces New Appointments

J. H. Jewell has been appointed manager of the industry departments of the Westinghouse Electric & Manufacturing Co. He has been a member of the Westinghouse organization since joining the company training course in 1920 as a sales student.

Edward Laing, who has been connected with Westinghouse since 1936 as sales promotion manager of the eastern district with headquarters in New York, has been made division manager in the headquarters application data and training department of the company in Pittsburgh. Before joining Westinghouse, Mr. Laing had spent 12 years in the manufacturing, advertising agency and technical publishing fields.

Harry A. Kinley, affiliated with the Westinghouse Lamp Division for 34 years, has been appointed manager of its district office at Detroit, Mich. Since 1940 he has been territorial representative for the Detroit district.

C. C. Franck has been made manager of land turbine engineering in the steam division of the company. Mr. Franck, who fills a position made vacant by the recently announced promotion of C. B. Campbell to manager of engineering, formerly was section engineer in charge of central station turbines.

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► M. C. CARROLL has been appointed general sales manager of the Royal Electric Co., Inc., Pawtucket, R. I. Mr. Carroll was formerly vice-president and sales manager of Chase-Shawmut Co.

► GEORGE M. TRIPP, general superintendent of the B. C. Electric Railway Co. on Vancouver Island, has recently retired after completing 46 years' continuous service with the company on Vancouver Island. Mr. Tripp's first assignment on Vancouver Island dates back to 1898 when, as an electrical engineer, he went to Victoria to supervise the installation of the first hydro electric units at the Goldstream generating plant, then under construction by the B. C. Electric Railway Co. When his work on behalf of the contractors on the Goldstream project was completed, he decided to remain there and entered the employ of the B. C. Electric Railway Co. At first he was placed in charge of the Goldstream plant and subsequently became the company's general superintendent with supervision over all electrical and mechanical work on Vancouver Island. Mr. Tripp initiated the preliminary surveys which eventually led to the adoption by the company of the Jordan River hydroelectric develop-

ment. He supervised the undertaking from the turning of the first sod to the ultimate installation of the fourth hydro electric unit, marking the maximum development of the Jordan River watershed. He also was closely identified with the erection and operation of the early steam plants; saw them serve their day and eventually give place to the modern steam-turbo generating plant, with its recently completed third unit of 8,000 kw. at Brentwood Bay.

OBITUARY

▸JOHN H. GOSS, who recently retired as president of the Scovill Manufacturing Co., Waterbury, Conn., died of a heart attack on October 16 at his home in that city. He was 72 years of age. Mr. Goss, who became chairman of the board when he resigned as president and general manager, had celebrated his fiftieth anniversary just before his retirement. He was a past-president of the Connecticut Association of Manufacturers.

▸JOHN D. MCDONALD, aged 70, engineer for many years with the West Kootenay Power Co., died at his home in Vancouver recently. Born in Woodstock, Ontario, Mr. McDonald has lived in British Columbia 46 years, 42 years of which he was employed as an electrical engineer.

▸E. F. WATKINS, manager of purchases, Southern California Edison Co., Los Angeles, died on October 1 at Los Angeles after several months' illness. Mr. Watkins was born 61 years ago in Alhambra and had been with the Edison company for 21 years, becoming manager of purchases in 1927. Mr. Watkins was a past-president of the Los Angeles Electric Club.

▸LOUIS W. PRATT, who was connected with the municipal engineering department of the Ontario Hydro-Electric Power Commission, died in the Toronto General Hospital on October 3 in his sixty-eighth year. Born in England, Mr. Pratt went to Canada at the age of 12. He joined the staff of the Brantford Electric Light Co. in 1896, subsequently becoming manager. Then he became identified with the Federal Electric Construction Co., becoming secretary-treasurer in 1906. Subsequently he entered the employ of the Dominion Power & Transmission Co. and from 1919 until 1931 was sales manager. At that time the Hydro-Electric Power Commission took over the Dominion Power. Mr. Pratt served as chairman of the commercial section of the Canadian Electrical Association.

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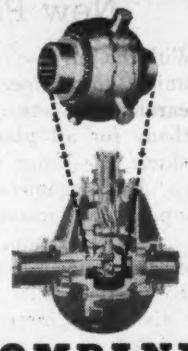

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MANUFACTURING MARKETS

Union Carbide Forms New Plastics Unit

With the purpose of co-ordinating the technical knowledge, sales engineering, research, production and distribution methods for all plastics and resinous products, the Union Carbide & Carbon Corp. has organized a new plastics group. By the formation of this important plastics group, the number of products groups into which the activities of the various units of the corporation are divided is increased from four to five.

Bakelite Corp., which has been a pioneer in the plastics industry, will carry on the integrated sales activities of the new plastics group. In addition to its present products, which include phenolic and urea resins and plastics, it will handle the sale of polyethylene resins which were originated and developed by The Linde Air Products Co. and which have been and will continue to be manufactured by Carbide & Carbon Chemicals Corp. Bakelite Corp. will also handle the sale of vinyl resins developed and produced by Carbide & Carbon Chemicals Corp.; it will fabricate and sell extrusion, calendering, and molding compounds produced from Carbide & Carbon Chemicals Corp.'s vinyl resins plasticizers, stabilizers, etc. Bakelite Corp. will also handle the sale of chlorinated naphthalene compounds used for electrical insulation and other purposes, which were developed and are manufactured by the Halowax Products Division of Union and Carbon Corp.

•

Noma Electric Forms Five Distribution Companies

In a letter to stockholders, Henri Sadacca, president of the Noma Electric Corp., stated that five companies already had been formed under the name of Noma Industries, Inc., in line with the company's post-war plans to insure maximum distribution outlets for its products and those of its subsidiaries. The five companies have been formed under the laws of Illinois, California, Ohio, Pennsylvania and Missouri. They are wholly-owned subsidiaries and will operate in their respective territories as branch warehouses and selling organizations, Mr. Sadacca said.

Stockholders also were informed that the company's wholly-owned subsidiary, the Ansonia Electrical Co., had exercised its option to purchase voting trust certificates representing 101,092 shares of common capital stock and 13,569 shares of common capital stock of Triumph Explosives, Inc.

•

High-Speed Studies Use Controlled Light

How light, electronically controlled, can be used for split-second studies of high-speed rotating machinery was one of the demonstrations made by Donald P. Caverly, commercial engineer for Syl-

vania Electric Products, Inc. and author of "A Primer of Electronics" in an address recently delivered at a meeting of the International Association of Electrical Inspectors in the Consolidated Edison Auditorium in New York.

Mr. Caverly used a strobotron tube to synchronize light flashes with the high-speed revolutions of a model airplane propeller to demonstrate how movement may be "stopped" for study or for a photograph of actual operation stresses. By simply turning a knob, the strobotron was made to flash so that the propeller appeared to be stationary, moving very slowly, or moving in the reverse direction.

He also demonstrated how electrons are used in cathode ray tubes to produce light according to exact patterns ranging from a simple line of dots to the complex patterns in a complete television image. These and other electronic devices are producing means for improving industrial production and control and other things which will make for better living for people everywhere in the post-war era.

•

G & W Electric Specialty Buys General Cable Line

Low-tension accessory business of General Cable Corp., New York, has recently been purchased for cash by the G & W Electric Specialty Co., Chicago, according to an announcement on Oct. 17 by George Edmonds, general manager of the Chicago firm. Product lines involved in the transaction include potheads, junction boxes, splicing kits and compound for 45-kv. and lower service, it was stated.

Negotiations were started earlier in the year but some little time has been used in deciding the best solution of the problems originally presented. Two things were to be accomplished, according to Mr. Edmonds: General Cable wished to devote its efforts to the manufacture of cable but wanted to assure customers of entirely adequate accessory service. G & W announces that there will be no change in its fully independent position of offering service to all accessory users and cable manufacturers on an impartial basis.

In that situation any exchange of stock shares or interlocked management could not be used, hence the ultimate arrangement under which G & W now will produce both their former and the new lines, emphasizing the best features of each. Inventory, patterns, and special manufacturing equipment together with engineering files, etc., are being moved from Perth Amboy to the G & W Chicago factory.

Dr. W. S. Brown, associated with General Cable accessories for many years has joined the G & W engineering staff, it was stated.

It is contemplated that production of General Cable accessories will be well under way at Chicago before the end of the year, Mr. Edmonds stated.

Official U. S. Marine Corps Photo

Keep Your Plant's Quota "OUT FRONT!"

Victory depends upon materials—as well as men! To keep our American forces "closing in" overseas, you and every other manufacturer here at home must *keep on making* "Out Front" War Bond Quotas!

This means *action now* on *every* point in the fighting 8-Point Plan to step up Payroll Deductions. For instance, have you a 6th War Loan Bond Committee, representing labor, management and other important groups in your company? Selected Team Captains yet—preferably returned veterans? If so, have you instructed them in sales procedure—and given each the Treasury Booklet, *Getting the Order*?

How about War Bond quotas? Each department—and individual—should have one! Assigning responsibilities is vital, too! Have you appointed enough "self-starters" to arrange rallies, competitive progress boards and meeting schedules? Are personal pledge, order or authorization cards printed, and made out in the name of each worker? Planning for resolicitation near the end of the drive? Your State Payroll Chairman is ready now with a detailed Resolicitation Plan. And, have you contracted for space in *all* your regular advertising media to tell the War Bond story?

Your positive *Yes* to *all* points in this forward-to-victory 8-Point Plan assures your plant meeting an "Out Front" Quota in the 6th War Loan—and speeds the day of unconditional surrender!

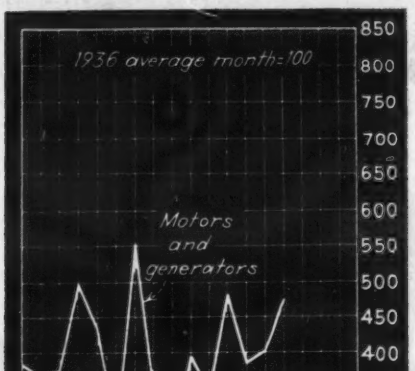
The Treasury Department acknowledges with appreciation the publication of this message by

ELECTRICAL WORLD

This is an official U. S. Treasury advertisement—prepared under the auspices of Treasury Department and War Advertising Council.

Generator, Motor Orders Advance 18%

New orders for motors and generators during the month of August rose 18 percent over the July total, according to figures released by the National Electrical Manufacturers Association. The NEMA index advanced to 476 from 403 in July. In August, 1943, the index stood



NEMA INDEX, value of orders received

at 377, this year's figure representing an increase of 26 percent over last year's.

Adjustment for cancellations reported up to December 31, 1943 is included in the 1943 indexes. No adjustment has been made for renegotiation of contracts.

Single-phase, integral hp. motors have been added to the series beginning with the month of January, 1944.

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Changes Corporate Name

Corporate name of the Black & Decker Electric Co., Kent, Ohio, has been changed to the Lamb Electric Co., according to R. J. Lamb, president. Officers of the present company have purchased all of the outstanding common stock and the organization is no longer a subsidiary of the Black & Decker Co. of Maryland (ELECTRICAL WORLD, September 30, page 134).

•

Sheldon Service Moves

Announcement has been made that the Sheldon Service Co. has moved from its Long Island City location to new headquarters at 652 Hudson Street, New York 14, N. Y.

Field Reports on Business

Electrical business from military sources consists essentially of maintenance material in most sections of the country, but the West is still the scene of much major military construction. Demand for wiring supplies is high and considerable activity in the lighting field is reported.

PACIFIC COAST

Present industrial conditions on the Pacific Coast are typified by the Hendy marine turbine plant at Sunnydale near San Francisco which, though considerably cut last spring, has received new government contracts which will employ its 5,000 men during 1945. Furthermore, the west is still the scene of much major military construction, at a time when electrical business from camps and fields in other parts of the nation is mainly maintenance material. The low bid for the naval supply depot near Stockton was $10,608,845; the $5,000,000 depot near Los Angeles is now under construction; the $2,500,000 appropriation for March Field, Riverside, includes much lighting material for new runways; and a $1,639,631 group of new structures for Port Chicago is only part of a $20,000,000 project.

Orders include many scattered awards, averaging $35,000 for lighting airfields and airports; $1,392,535 for an American Bridge crane at Hunter's Point; several carloads of poles sizes 40 to 55 feet for Burbank, Calif., many groups of switchboards for camp and field additions; $40,000 of battery chargers and motor generator sets, $20,000 of oscillograph equipment for University of California; a considerable shipment of turbine parts for Navy, and a substation and ground equipment for a CAA installation.

Industrial developments are featured by United Air Lines order for 93 air transports, costing $50,000,000, from Douglas Aircraft; and include the conversion of a 100 octane plant at Cheyenne to a black oil manufacturing installation; and an award of a 14,000-ton floating drydock to a Kaiser subsidiary.

NEW ENGLAND

Motor pumping units, precision timing apparatus, and special control apparatus required for conducting tests are among high priority electrical equipment items, demands for which are being pressed on manufacturers in this district. Backlogs still prevail and deliveries are far behind demands. Bidding on Navy supplies has slackened; a steady movement of wiring supplies to ship repair yards in this area continues where conversion of ships to hospital service is in progress. Distribution circuit materials are dominating among electrical purchases. Small motor sales are spotty.

Haverhill (Mass.) Electric Light Co. will install ten 1000-lumen highway lights on Wall Street. Connecticut manufacturers are receiving encouraging orders for small electrical bench tools and small lots of wire and cable are moving at a steady pace. Recent awards received in this area include circuit breakers, Spencer Thermostat Co., Attleboro, Mass., General Radio radio supplies and parts, United Shoe Machinery Corp. repair machines, control apparatus (one lot of 4,650 canopy type toggle switches was sold by Arrow-Hart & Hegeman Electric Co., Hartford) and ten International Equipment Co. centrifuges.

Last week bidding on Navy needs included small lots of wire and cable, electric bench tools which attracted the attention of Connecticut companies, radio supplies and communication apparatus. Larger overseas deliveries are being earmarked by manufacturers in this area. No let-down is noted in the activity among manufacturers of communication and signalling apparatus. Installation of motors and charges in factory lay-outs in the Greater Boston area are in good number and forecast planning for reconversion to domestic production of supplies as soon as restrictions are released.

NEW YORK

Corporate bond issues offered to the public during the week ended October 21 reached the highest total on record for a week's activity—$346,450,000. Of this sum $292,000,000 represented three public utility companies and $54,450,000 three municipalities. The feature of the week was the flotation and over subsription on the day of offering of $155,000,000 Commonwealth Edison Co. bonds.

Civil engineering construction in continental United States totalled $20,812,000 last week. This volume was 64 percent lower than in the preceding week, and 59 percent below the corresponding 1943 week, Engineering News-Record reports. Private work was 18 percent lower than the preceding week and 40 percent under a year ago. Public construction declined 69 percent and 62 percent, respectively, from the preceding week and last year. The week's construction brought 1944 volume to $1,484,582,000 for the 42 weeks, a decrease of 44 percent from the $2,649,767,000 reported in the corresponding 1943 period.

Department store sales last week advanced 23 percent over the corresponding period last year, according to estimates made.

CHICAGO

Chicago's city council recently approved issuance of a $3,000,000 bond issue to finance improvement and extension of the city's electric street lighting system. Early estimates call for the purchase of 12,000 new street lights.

Cincinnati Gas & Electric Co. has received approval for and will soon start construction on seven miles of double-circuit, steel-tower transmission line, using 400,000 cir. mil stranded copper conductor, to serve the Cincinnati barrier dam pumping station which is part of the Ohio River flood control system there. The transmission project is scheduled for completion in January.

Electrical Engineers Equipment Co. in Melrose Park, Ill., has recently been awarded a contract by the procurement division of the Treasury Department for 161-kv. oil circuit breakers and switches for Park Dam power plant and Phoenix substation, Davis Dam Project. Chicago Transformer Corporation received a Navy order for "materials for starting compensators" of undisclosed identity and amount. In all, during the week ending October 12, some 65 Chicago area concerns received 68 war orders, totaling approximately $995,000, according to the Chicago Association of Commerce report. Electrical equipment orders represented a negligible portion of this amount.

Sales Opportunities

LOUISIANA—New Orleans Public Service, Inc., New Orleans, plans post-war expansion program at generating station, including installation of high-pressure boilers, turbine-generator and auxiliary equipment. Cost reported over $3,500,000. Also will make extensions in underground and overhead transmission and distribution lines at same time, with additional power substation facilities. At a later date company proposes to construct a new steam-electric generating station for increased service in city and suburban areas, with an initial estimated expenditure reported to approximate $10,000,000.

PENNSYLVANIA—Pennzoil Co., Oil City, plans expansion in oil refining plant, including new solvent dewaxing and wax recrystallization works, comprising several units. Entire project will cost about $1,400,000, with machinery and electrical equipment. Project has a priority rating and work is scheduled for completion early next spring.

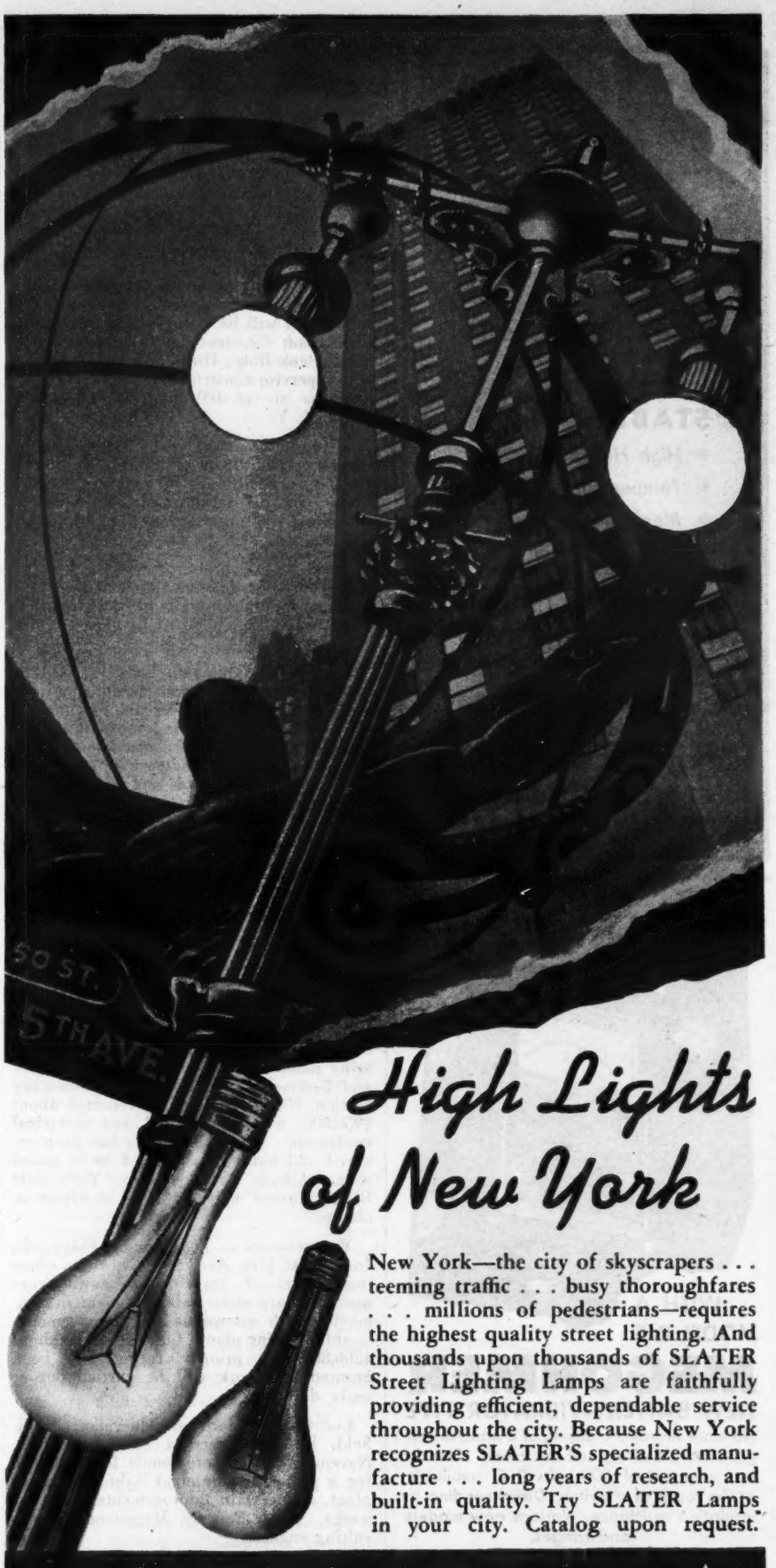
INDIANA—Board of Trustees, Indiana State Sanitarium, Rockville, plans addition to power plant and installation of new equipment. Project will be carried out in connection with a post-war expansion progam at institution, including two new buildings, with total estimated cost about $750,000.

NEBRASKA—Board of Public Works, Fremont, has been authorized to call for bids for extensions in municipal steam-electric power plant, including purchase of new boiler and accessories, 2,500-kw. turbine-generator unit and auxiliary equipment. Project has secured a priority rating. Cost estimated about $428,700. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

WYOMING—Bureau of Mines, Department of Interior, Washington, D. C., has plans under way for new three and four-story shale laboratory, about 175 x 200 ft., at University of Wyoming, Laramie. Cost estimated about $680,000, of which approximately $200,000 will be expended for mechanical and electrical equipment. Plans are scheduled for completion in December, when bids will be asked. Frederic H. Porter, 2118 Central Ave., Cheyenne, is architect. H. P. Rue is contracting officer for Bureau at Laramie.

GEORGIA—Georgia Power Co., Atlanta, is placing contracts for construction work and primary equipment for addition to steam-electric generating station, and will place orders for auxiliary equipment required at early date. Award has been made to Westinghouse Electric & Mfg. Co., for a 60,000-kw. turbine-generator unit, and to Combustion Engineering Co. for high-pressure boiler. Contract has been let to Van Winkle & Co., Norris Bldg., Atlanta, for erection of steel frame superstructure, which is scheduled for completion next January. Project has a priority rating and is estimated to cost over $4,000,000. Engineering department of Commonwealth & Southern Corp., Birmingham, Ala., is consulting engineer.

NEW YORK—Hudson-Varick Corp., subsidiary of Tishman Realty & Construction Co., 136 East 57th St., New York, plans installation of a central power station for light and power service, and boiler plant for central-heating installation in new 13-story industrial building on local site.



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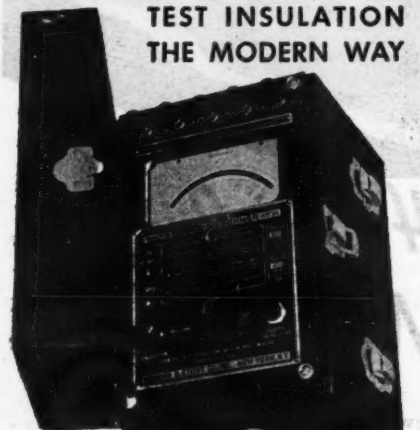

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Structure will total 2,500,000 sq. ft. of floor space and will be carried out as a post-war project. Cost estimated about $6,000,000. Victor Mayper, 110 West 40th St., New York, is consulting engineer..

TEXAS—Celanese Corp. of America, Inc., Bishop, plans addition to local chemical works for production of butadiene, an ingredient of synthetic rubber, comprising several one and multi-story structures, towers and other units, equipped for large output. Cost reported in excess of $2,500,000, with machinery and electrical equipment. Project will have a priority rating and will be placed under way soon. Gulf Plant Construction Co., Second National Bank Bldg., Houston, is engineer and will supervise construction. Main offices of company are at 180 Madison Ave., New York, N. Y.

WASHINGTON—Bonneville Power Administration, Department of Interior, 811 N. E. Oregon St., Portland, Ore., plans new steel frame control station and oil house at switching station. Contract for structural steel framing will be awarded soon.

NEBRASKA—Nebraska Power Co., Omaha, has secured permission for extensions in transmission lines in parts of three counties, and work is scheduled to be placed under way at early date.

MISSOURI—Municipal Utilities Department, Slater, plans expansion and improvements in municipal power plant as a post-war project, with installation of equipment. Estimates of cost will be made soon. Also plans installation of motor-driven pumping machinery, with controls and accessories in connection with proposed extensions in water system, similarly as a post-war development. R. R. Howard is city engineer.

OHIO—Department of Light and Power, Cleveland, plans new one-story maintenance and repair shop at yard, to be carried out as a post-war project. Cost reported over $300,000, with equipment. Herman Kregelius, City Hall, city architect, will prepare plans.

NEBRASKA—Dean Sack, president. York State Bank, York, is at head of project to construct new food-processing and refrigerating plant on local site, to be three-story and basement, 75 x 105 ft., with one-story section, 108 x 156 ft. Cost reported about $250,000, with mechanical and electrical equipment. A priority rating has been secured and bids are scheduled to be asked soon. Alfred Benberg, New York Life Bldg., Kansas City, Mo., is architect in charge.

WASHINGTON — Todd-Pacific Shipyards, Inc., 2400 11th Ave. S.W., Seattle, plans installation of transformers, switchgear and auxiliary electrical equipment in connection with extensions and improvements in shipbuilding plant. Cost estimated about $206,800. A priority rating has been granted and work will be carried out at early date.

LOUISIANA—Board of Alderman, Winnfield, has authorized a special election, November 21, to vote bonds for $260,000, for a proposed municipal light and power plant, and certain improvements in waterworks. J. M. Fourmy, Hammond, is consulting engineer.

MISSOURI—Southwest Electric Cooperative, Bolivar, is having surveys and plans made by Frank Horton & Co., Lamar, consulting engineers, for extensions in rural electric system in parts of five counties, totaling about 143 miles, with service connections and other operating facilities. Work is scheduled to begin soon.

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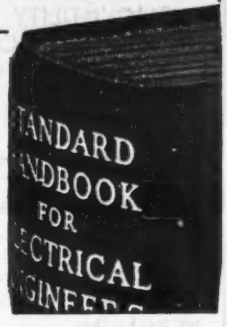

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Recent Rate Changes

SOUTHWESTERN PUBLIC SERVICE CO. has announced substantial savings for residential and commercial electric energy users in the Pecos Valley. H. E. Samson, district manager of the company in Roswell, N. M., stated that a reduction in rates, to become effective immediately, would effect savings to users in the amount of approximately $42,500 annually. Roswell, one of the eight towns where reductions are applicable, will be the greatest beneficiary of the reduction. Other towns where the reduction applies are Carlsbad, Artesia, Dexter, Espuella, Hagerman, Lake Arthur and Loving. The new rates have been approved by the state Public Service Commission. For residences, the new schedule is 5½ cents per kilowatt-hour for the first 35 kw.-hr.; 4 cents per kilowatt hour for the next 65 kilowatt-hours; 2½ cents per kilowatt-hour for the next 50 kw.-hr. and 2 cents per kilowatt-hour for all over 150 kw.-hr. For commercial lighting, the new rate is 5½ cents per kilowatt-hour for the first 100 kw.-hr.; 4 cents for the next 400 kw.-hr.; 3 cents for the next 1,000 kw.-hr. and 2 cents per kilowatt-hour for all over 1,500 kw.-hr.

INDIANA GENERAL SERVICE CO., Marion, Ind., has made an agreement with the state Public Service Commission under the terms of which cities which are customers of the utility will save approximately $50,000 annually in rate charges. The cities include Muncie, Marion, Elwood and Hartford City. The reductions apply to service in public buildings and municipal street lighting. The new rates became effective October 16.

ARKANSAS POWER & LIGHT CO.'s contract with North Little Rock, reducing by 13 percent the rate for electricity purchased by the municipality, has been ratified by the city council. The contract is retroactive to October 1, 1943, and will be effective through October 1, 1953, when it will be automatically extended for one-year periods until ended by written notice from one of the parties.

FLORIDA POWER CORP.'s rate schedule, providing for the sale and delivery of electric energy to the city of Quincy for resale, has been suspended by the Federal Power Commission. Hearing has been set for November 15 in Washington, D. C. The order stated that the schedule filed by the company in July to supersede the one now in effect may result in "excessive rates or charges to the city of Quincy; may place an undue burden upon ultimate consumers of electric energy; may be discriminatory; and will result in increased rates or charges which have not been shown to be justified." The changes would result in an annual increase in charges of $13,965, or 20.5 percent. The order stated that at the hearing the burden of proof to show that the proposed increased rates are just and reasonable shall be upon the Florida Power Corp. The commission's order suspended the proposed rate schedule until January 15, 1945, and provided that the present wholesale rates shall continue in effect.

CONSUMERS PUBLIC POWER DISTRICT, Lincoln, Nebr., has announced rate reductions, effective on meter readings September 5, actually accruing to the customer as of August 5. It is reckoned over the statewide system at a 10 percent average and is a saving to Lincoln patrons of the district reckoned at $110,000 annually. This, coupled with the city plant's recent 10 percent reduction, $32,000 saved to its consumers annually, makes a total saving to customers of both systems of $142,000 per year.

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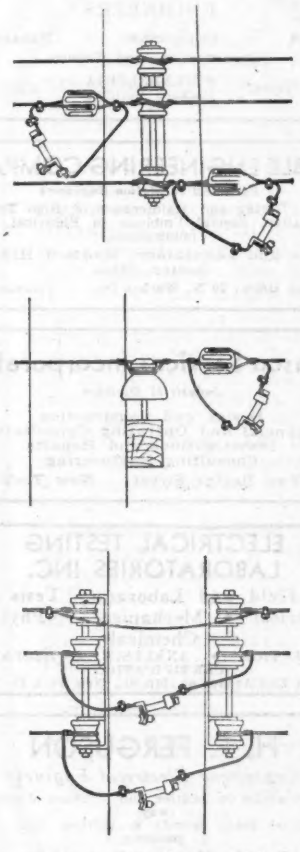
Rating:
100 Amperes 250 Volts
Rupturing Capacity
5000 Amperes

You can fuse them with any make of standard primary fuse links.

They indicate outages.

For isolating service entrance faults; for protecting banked transformer secondaries; or for protecting transformers from secondary faults, Matthews Secondary Cutouts have proved themselves very efficient and low-in-cost for many years.

For Sectionalizing as shown below.



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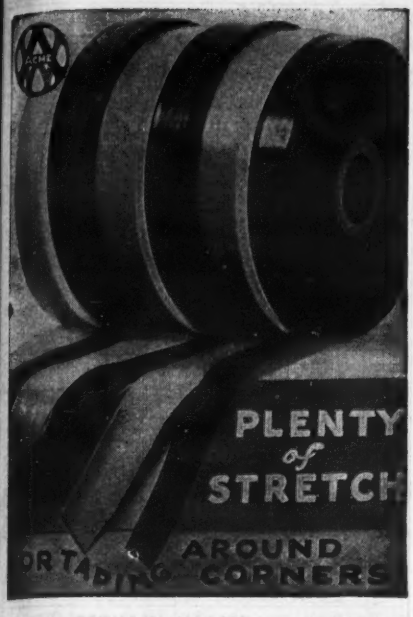

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are made of high grade cotton fabric treated with special varnishes from Acme's own varnish plant. They have great tensile strength and flexibility and may be stretched snugly into all corners and crevices, making a mechanically smooth and electrically efficient seal. Offered in bias or straight tapes or rolls up to 36" wide, yellow or black. Samples if requested. Address *The Acme Wire Co., New Haven, Conn.*

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VARNISHED INSULATIONS — MAGNET WIRE COILS

Slack Quickly and Safely Taken up!

No. 324 Simplex Wire Tensioning Jack. 2-tons capacity. 20¼" take-up with every grip. Weighs only 13 lbs.

One man readily and safely pulls overhead and underground cables, or takes up the slack in guy, trolley and transport wires. Quickly hitched, using standard wire grips and slings. Exerts a powerful straight line pull. Lever has safety clip—cannot fall out.

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LEVER SCREW - HYDRAULIC
Jacks

Templeton, Kenly & Co.
Chicago (44), Illinois
Better, Safer Jacks Since 1899

REA Funds Allotted for Rural Projects

The Rural Electrification Administration has recently made loan allotments totaling $2,212,000 to 20 rural cooperatives in 14 states. This brings total REA allotments to $510,409,301, the current fiscal year's operations amounting to $11,529,500.

Unless otherwise noted, the loans listed below will be used mainly for the extension of electric service to farms located near existing lines.

ALABAMA—Pioneer Electric Cooperative, Inc., Greenville, $60,000. for service extensions, substation installation and necessary tie-line.

COLORADO—Highline Electric Assn., Holyoke, $420,000. for service extensions, construction of line and a substation.

FLORIDA—Central Florida Electric Cooperative, Inc., Chiefland, $25,000.

GEORGIA—Little Ocmulgee Electric Membership Corp., Alamo, $25,000.

ILLINOIS—Southern Illinois Electric Cooperative, Dongola, $50,000.

IOWA—Hardin County Rural Electric Cooperative, Iowa Falls, $60,000.

MISSOURI—Barton County Electric Cooperative, Lamar, $75,000; Pemiscot-Dunklin Electric Cooperative, Havti, $65,000.

NEBRASKA—Southern Nebraska Rural Public Power District, Grand Island, $50,000, for connections and necessary line changes.

OHIO—Inter-County Rural Electric Cooperative, Inc., Hillsboro, $50,000; South Central Rural Electric Cooperative, Inc., Lancaster, $910.000.

OKLAHOMA—Northfork Electric Cooperative, Inc., Sayre, $85.000.

TENNESSEE—Forked Deer Electric Cooperative, Inc., Halls, $25,000.

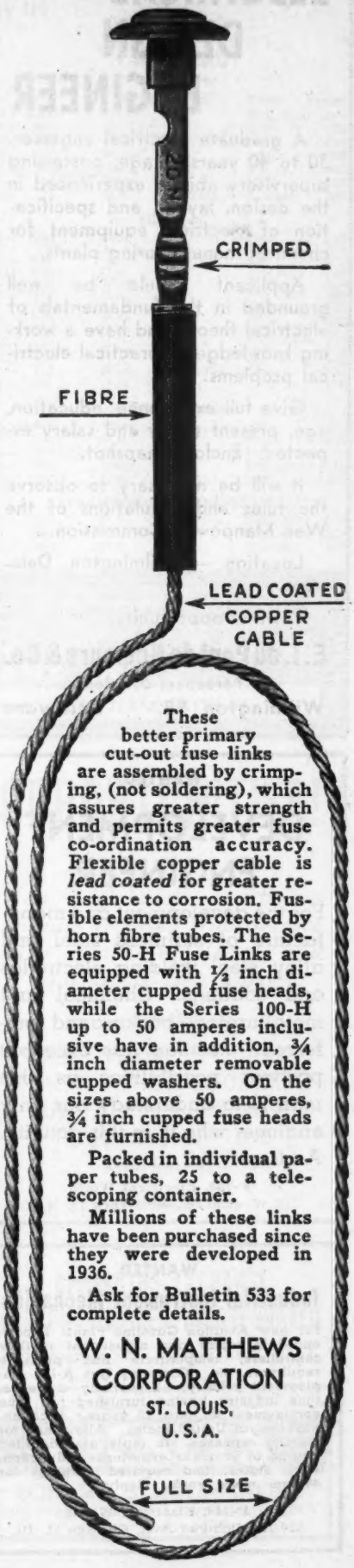
TEXAS—Jasper-Newton Electric Cooperative, Inc., Kirbyville, $125,000, for extensions, substation equipment and tie-line; Belfalls Electric Cooperative, Inc., Rosebud, $30.000; Mart Refrigeration Cooperative, Inc., Mart, $30,000, for refrigerated locker plant; Limestone Refrigeration Cooperative, Inc., Groesbeck, $28,000, for refrigerated locker plant; DeWitt County Electric Cooperative, Inc., Cuero, $25,000.

VIRGINIA—Mountain Refrigeration Cooperative, Inc., Hot Springs, $9,000, for completion of refrigerated locker plant.

WISCONSIN—Lafayette Electric Cooperative, Darlington, $65,000.

Subox
ANTI-CORROSIVE PAINTS
favored for
TRANSMISSION
and
DISTRIBUTION DEPARTMENTS
MAINTENANCE
Subox, Inc.
NORTH ARLINGTON N. J.

50-H AND 100-H MATTHEWS FUSE LINKS



These better primary cut-out fuse links are assembled by crimping, (not soldering), which assures greater strength and permits greater fuse co-ordination accuracy. Flexible copper cable is *lead coated* for greater resistance to corrosion. Fusible elements protected by horn fibre tubes. The Series 50-H Fuse Links are equipped with ½ inch diameter cupped fuse heads, while the Series 100-H up to 50 amperes inclusive have in addition, ¾ inch diameter removable cupped washers. On the sizes above 50 amperes, ¾ inch cupped fuse heads are furnished.

Packed in individual paper tubes, 25 to a telescoping container.

Millions of these links have been purchased since they were developed in 1936.

Ask for Bulletin 533 for complete details.

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.

ELECTRICAL DESIGN ENGINEER

A graduate electrical engineer, 30 to 40 years of age, possessing supervisory ability, experienced in the design, layout, and specification of electrical equipment for chemical manufacturing plants.

Applicant should be well grounded in the fundamentals of electrical theory and have a working knowledge of practical electrical problems.

Give full experience, education, age, present salary and salary expected. Enclose snapshot.

It will be necessary to observe the rules and regulations of the War Manpower Commission.

Location — Wilmington, Delaware.

Postwar opportunity.

E. I. du Pont de Nemours & Co.
Personnel Division
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WANTED

DEVELOPMENT ENGINEER

For the development and manufacture of stainless steel and alloy steel welding electrodes and coatings. Chemical and metallurgical background preferred. Position has excellent postwar possibilities as this man is to understudy our only engineer who is in this activity. Address

P-755, Electrical World
330 W. 42nd St., New York 18, N. Y.

WANTED

Industrial Instrument Mechanics

For new Aviation Gasoline Plant. Experienced in repair and adjustment of flow controllers, temperature and pressure regulators, etc. Company has A-1-A employment priority. Essentially a peacetime industry having furnished full time employment for past 20 years. Location, east-central United States. Allowance for moving expenses. In reply give detailed outline of previous experience, education, draft status, and required earnings for 48-hour work week. Reply

P-746, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

POSITIONS VACANT

PRODUCTION ENGINEER — fractional h.p. electric motors. Should have specialty background in single phase motors, having devoted major effort to efficient mass production. Line will have limited size range. Engineering design experience desirable for development of motors for tooling and production. Permanent connection with outstanding Southern California manufacturer entering household appliance field. Send detail of experience and personal qualifications to A.W.A., Box 68, Station K, Los Angeles, California.

POWER STATION operator experienced in maintenance heavy hydraulic equipment, especially reaction turbines, required by Public Utility in Brazil. Should be capable taking charge of operation large modern hydro electric plant. Location healthy. Give complete resume experience, references, marital status and salary expected. P-763, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL ENGINEER wanted. One of Connecticut's oldest and largest manufacturers wants engineer experienced in design and manufacture of electrical instruments and control devices for industrial and household applications. Very desirable permanent position with extremely interesting present and postwar prospects. Salary from $7,200 to $10,000 according to capability. Write giving age, educational background, experience, references, salary required, when available. Replies will be held in strict confidence. P-761, Electrical World, 330 W. 42nd St., New York 18, N. Y.

WANTED—EXPERIENCED lineman—permanent—town 5000 population—location, Massachusetts. State age—married—single—weight—reference. P-762, Electrical World, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 34 years recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission's. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo 2, N. Y.

WANTED

EXECUTIVE ENGINEERING ASSISTANT

Large midwest electric utility wants graduate engineer about 30 to 35 for work in the fields of rates, rate regulation, cost of service allocations, depreciation studies, etc.

Specific experience in any of the fields will be helpful. Familiarity with electric utility property, a keen analytical mind, efficient job organization habits and a better than average ability in clear and effective expression are essential.

The position is a permanent staff position and offers excellent opportunity to a young engineer with ability and initiative.

P-759, Electrical World
520 North Michigan Ave., Chicago 11, Ill.

POSITIONS WANTED

ASSISTANT TO executive, E.E., eighteen years experience in Public Utility operation, rate design and analyses, depreciation studies, regulatory problems. Now employed. Circumstances dictate change desirable. Salary $5,000 minimum. Interview solicited. PW-758, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ENGINEER—Mechanical electrical experienced in design, construction, operation including generation, transmission, distribution and industrial plants. Also planning and development work. Presently employed—desire change. PW-764, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL SUPT. 25 years experience: installation, operation, and maintenance of electrical equipment. Accounting, estimating etc. Some knowledge of electronics. Desire position with utility or manufacturer. Past draft age. Good health. Thirty days notice preferred. PW-765, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

MAN FORTY years of age with eighteen years Public Utilities experience wants offer. Experienced in all kind of line work, city distribution systems, sub-stations, transformers, automatic controls, testing and installing all kind of meters and instruments. Two years commercial electrical experience in large plants. Also supervisory experience. High school education. short course in electrical engineering. Have been in war work, available with short notice, offer must be of a permanent nature. Best of references, complete details of experience on request. PW-766, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

SALESMAN WANTED

WANTED—SALESMAN who has experience on transformer sales and repairs, covering New England, New York State and Pennsylvania. We want a high type man who has had engineering experience on transformers and power apparatus. SW-751, Electrical World, 330 W. 42nd St., New York 18, N. Y.

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for plant manufacturing large and small transformers. Must be an experienced salesman with some experience in the control of salesmen and agents and capable of handling correspondence with sales staff. Traveling required.

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Experienced Sales Specialist seeks Post-War representation (for Union of South Africa) of Modern Household Electrical Appliances of quality. Advertiser is demobilized S A Air Force Officer and is prepared to proceed overseas for discussion and consultation if necessary. Bankers and other references available. Write—

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One Year Guarantee

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"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

HP	Make	Type	Volts	Speed
1250	G.E.	MPC	550	130
1200	Whse.	Compen.	550	600/720
800	G.E.	MPC	660	600
625	G.E.	MPC	500	130
600	G.E.	MPC	600	650/900
500	G.E.	MPC	230	900
500	Whse.	Compen.	250	840/720
350	G.E.	MPC	220	450
300	G.E.	DMC	230	400/600
300	G.E.	MPC	230	275/550
250	G.E.	C	230	375
250	Al. Ch.		230	525
200	Whse.		230	400
175	Whse.	SK	250	150/525
150	G.Ea	MPC	230	250/450
150	G.E.	RC-19A	230	800/1000
130	Cr. Wh.	CMC-65H	550	1200
130	Whse.	SK-185	110	450/1340
125	G.E.	CO-1832	230	625
100	G E.	LC-50	230	1200
100	G.E.	MPC	230	225/450
100	G E.	RC-38	230	600
100	Al. Ch.	Int.	230	950/1150
75/100	Whse.	SK-183	230	450/900
75	G.E.	LC	230	500/1000
75	Whse.	SK-183	230	560/1100
60	El. Dy.	258	230	525/1050
50/60	Cr. Wh.	65H	230	500/1000
50	Cr. Wh.	CMC-81H	230	300/900
50	G.E.	RC-19	230	400/1200

TRANSFORMERS

KVA	Make	ϕ PH	Type	Voltage
1667	Pitts.	1	OISC	13200x2300
1050	G.E.	3	WCTH	11000x445
600	G.E.	3	HT-OISC	11550x2200
333	Moloney	1	C-OISC	22000/11000x2300/575
333	Whse.	1	OISC	2300x460
333	Pitts.	1	OISC	2400x220
300	G.E.	1	H-RP	13200x575/1150/2300
300	Pitts.	3	ODSC	4150x208/120
300	Packard	1	OISC	2200x220/440
200	G.E.	1	H-IDD	26400x115/460

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP 2300 V.
1—1000 KW G. E. 250 V. DC to 1400 HP—2300 V.
1—500 KW G. E. 250 V. DC to 700 HP—440/2300 V.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW GE 250/275 V. Gen. d.c. to 650 HP—2300 V.
1—350 KW G. E. 220 v AC Gen. d.c. to 500 HP 250 v DC motor.
1—250 KW G. E. 250 V. DC to 375 HP—440 V.
1—300 KW G. E. 250 V. DC to 400 KVA—2300
1—75 KW G. E. 125 V. Gen. to 120 HP IK 400/2300
1—50 KW GE 135 V. Gen. to 75 HP KT 4000/2300 V.
1—35 KW Whse 125 V. DC to 53 HP—440/2200 V.
1—25 KW G. E. 250 V. DC to 40 HP—220 V.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 cycle

KW	Make	Speed	D.C. Volt	Trans. Volts
1— 1500	Whse.	720	600	2300
1— 1500	Whse.	600	600	11500
1— 1250	G.E.	720	250	2300
1— 1000	G.E.	900	600	13200
1— 1000	Whse.	600	250	22000
1— 1000	Whse.	900	600	11000
1— 750	G.E.	1200	600	2300
1— 750	Whse.	720	250	6600/2300
1— 500	Whse.	1200	600	13200/2300
1— 375	G.E.	1200	250	6600/2300
2— 300	G.E.	1200	600	2300

25 cycle

2— 1500	G.E.	500	225/275	13200/6600
1— 500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle
Synchronous

	HP	Make	Type	Volts	Speed
2—	2100	G.E.	ATI	2300/4600	514
1—	600	Al. Ch.		2200	720
1—	400	G.E.	TS-7647	2300	720
1—	150	Whse.		4000	1800
1—	225	G.E.	ATI	240	600
1—	100	Whse.	G	2200	1800
1—	75	G.E.	TS-7556	220/440	600

Slip Ring

1—	1200	Cr.-Wh.	801-Q	2200	237
1—	800	Al. Ch.		440	385
1—	600	G.E.	MT	550	220
2—	600	G.E.	IP	440/2200	720
1—	450	Whse.	CW	2200	575
1—	400	G.E.	IP	440/2200	600
1—	400	Al. Ch.		2300	505
1—	400	G.E.	IP	2200	252
1—	300	G E.	IM	2300/4000	257
1—	250	G E.	MT	4000/2300	257
1—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	600
1—	150	Whse.	CW-772C	2200	1160
1—	150	G.E.	IM	2200	575

Squirrel Cage

1—	300	Whse.	CS	550	580
1—	300	G.E.	IK	2300	600
1—	175/112	G.E.	IK	440	900/720
1—	125	Whse.	CS	220/550	1150
1—	100	G.E.	IE-13	2200	1800

SYNCHRONOUS CONDENSERS

1—	1000	G.E.	AT1	2200/3800	900
1—	900	G.E.	AT1	2200, 6600	1200
1—	750	G.E.	AT1	220/440	900

REBUILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 51 HOWELL ST., JERSEY CITY, N. J.

J.L.HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT

1602 53rd Street, North Bergen, N. J.

N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTORS

3 PHASE 60 CYCLE

1—600 HP, 900 RPM, 440 volt, Lincoln slip ring
1—350 HP, 300 RPM, 440 volt, G.E. slip ring
1—250 HP, 600 RPM, 4000 volt, G E. sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E. sq. cg.
2—150 HP, 1200 RPM, Westinghouse, squirrel cage
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
3— 75 HP, 1200 RPM, 2300 volt, G.E. vertical

D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM.
1— 75 HP, 575 RPM, General Electric
3— 50 HP, 700 RPM, Crocker-Wheeler

VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electric Dynamic.
1—60 HP, 500/1000 RPM, Diehl.
1—30 HP, 225/900 RPM, Crocker-Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
2—25 HP, 650/2200 RPM, Westinghouse.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1— 5 HP, 600/1200 RPM, General Electric.
1— 5 HP, 450/1800 RPM, Crocker-Wheeler.

MOTOR GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, Synchronous.
1— 75 KW, 125 volt, General Electric, squirrel cage.

TRANSFORMERS

2—400 KVA, G.E. 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh 7800/440 volts.
3—200 KVA, Allis-Chalmers, 2200/220/440 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
4—150 KVA, G.E., 2400/240/480.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110.
3— 75 KVA, General Electric 2200/220/440.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies.

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1—312 KVA Ridgeway 3 phase, 60 cycle, 3600 RPM, 480 volt, direct connected, Elliot-Kerr Condensing Steam Turbine, all in excellent operating condition. Offered for immediate shipment. For detailed specifications write to

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SAVE TIME

To save time and money—your time and your money—that's the purpose of the many products and services advertised in this issue of Electrical World. Check through the advertising pages for information that can be of direct benefit to you.

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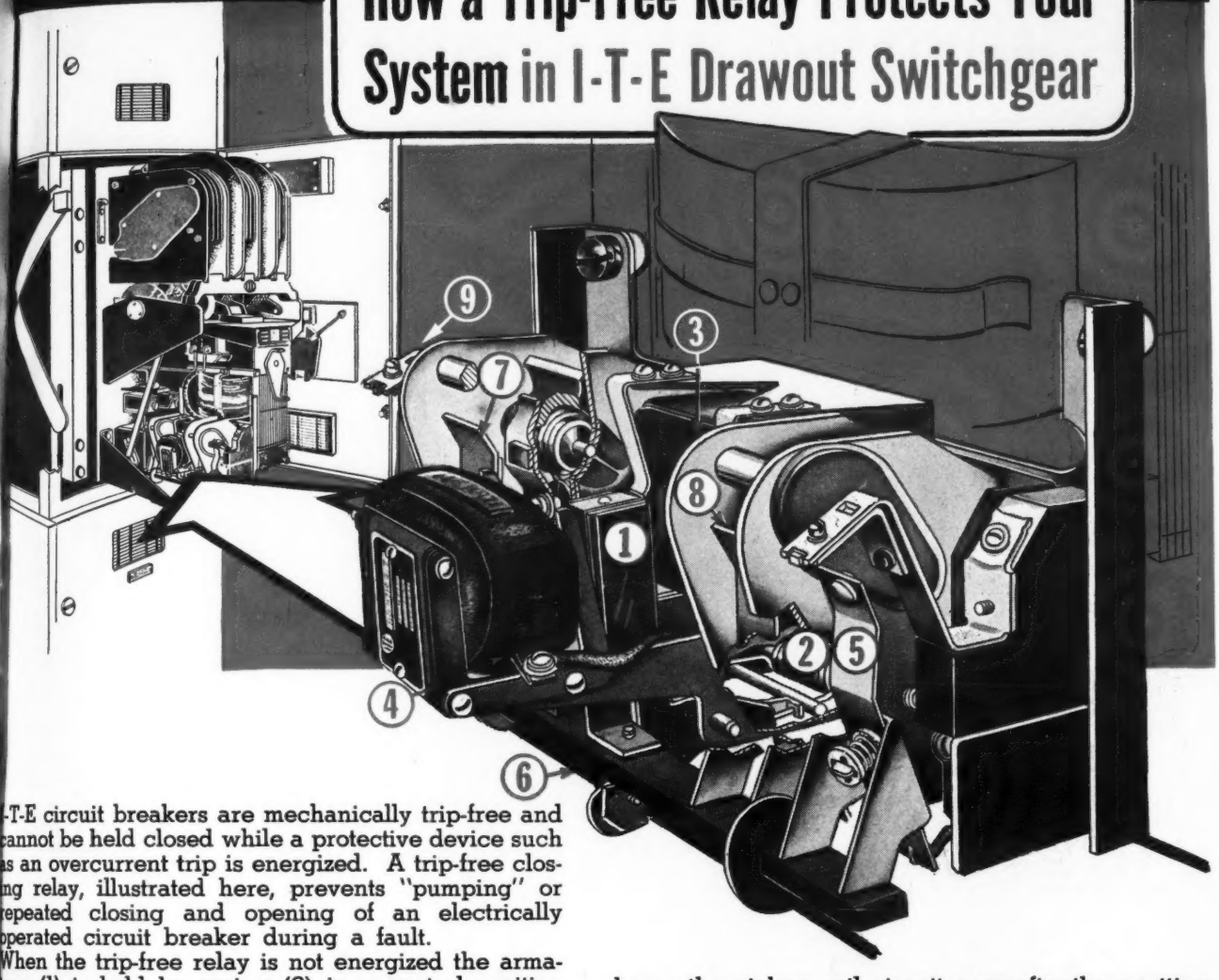
★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

How a Trip-Free Relay Protects Your System in I-T-E Drawout Switchgear



I-T-E circuit breakers are mechanically trip-free and cannot be held closed while a protective device such as an overcurrent trip is energized. A trip-free closing relay, illustrated here, prevents "pumping" or repeated closing and opening of an electrically operated circuit breaker during a fault.

When the trip-free relay is not energized the armature (1) is held by spring (2) in a central position between the magnet pole faces of the pickup coil (3) and the hold-open coil (4). Auxiliary contact (5) is closed.

When the control switch is operated both coil (3) and coil (4) are energized. The magnet energized by coil (3) is the more powerful and attracts armature (1). The movement of the armature rotates the operating shaft (6) and closes the main contacts (7) and (8). This completes the circuit breaker closing coil circuit, the coil is energized and the breaker closes. When the breaker closes, an auxiliary switch connected to the circuit breaker closing mechanism opens the circuit through coil (3). Coil (4) is still energized and its magnet attracts armature (1), rotating shaft (6) and opening the main contacts (3) and (4) and the auxiliary contact (5).

If the control switch is a type that remains closed, such as a float switch, auxiliary contact (5) is wired in series with closing coil (3) and the auxiliary switch and keeps the pickup coil circuit open after the resetting of the mechanism causes the auxiliary switch to reclose. Another auxiliary contact (9) is available for such services as interlocking. Both auxiliary contacts are reversible and may be made either circuit opening or circuit closing.

The purpose of identifying the essential parts of an I-T-E trip-free relay and of describing their function is to offer an example—of I-T-E's willingness to give complete data whenever switchgear is to be planned or specified as new equipment or changed to meet new conditions. From or through the I-T-E representative nearest you, you can have all the helpful information your problem requires. Much of the information is available with illustrations of the kind shown above, prepared with the thought of saving your time and of indicating the care given by I-T-E in design and construction. Ask your representative or write to I-T-E Circuit Breaker Company, 19th & Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E AIR SWITCHGEAR

ARMY E NAVY I-T-E

KUHLMAN Transformers and DETROIT Rocking Electric Furnaces Speed Foundry Production

Kuhlman power transformers and Detroit Rocking Electric furnaces, both products of the Kuhlman Electric Co., are a great team for speeding up foundry production in war as well as in peace. The five OISC transformers shown here are on their way to an important production job. Each is rated 250 KVA, 2500 Secondary Amperes and 6900/13,800 —100 volts, single phase, 60 cycle with external tap changers for adjusting both primary voltage and reactance.

Tested and proven for over 25 years, there are more than a thousand Detroit Electric Furnace installations operating today throughout the world. Fast, versatile, flexible and efficient, Detroit furnaces are available in capacities from 10 to 8000 lbs. molten metal capacity for melting both ferrous and non-ferrous metals and alloys. They improve castings quality, save labor, save floor space and permit the use of salvage materials. Write for complete facts regarding present day and post-war applications.

Kuhlman ELECTRIC COMPANY · BAY CITY, MICHIGAN